THE HEATING AND VENTILATING MAGAZINE

1123 BROADWAY NEW YORK MARCH, 1906

Reconstructing a Central Power and Heating Plant

Supplying a Cathedral, Two School Buildings, See House and Deanery at Garden City, Long Island, from One Source, with Heat and Power

A work recently completed for the Cathedral Corporation, of the Cathedral of the Incarnation, at Garden City, Long Island, involved a reconstruction of the entire steam piping below the first floors of all of the corporation's five buildings, the building of a miniature tunnel containing two lines of high pressure steam and return mains, and a remodeling of the power house. The contract called for the removal of all the existing underground steam pipes, and for the erection of a new radial brick chimney, 120 feet high, for the boiler plant, and the building of an extension to the present boiler house for the reception of pumps, feed water heater, filter, etc.

The buildings, at the time the work was undertaken, were supplied with high-pressure steam through two sections of main leads. One lead started from the boiler house and ran to the heating and power fixtures in St. Paul's School. The second lead left the power house and supplied the Cathedral, See House and conservatory, St. Mary's School and the Deanery. The distance from St. Paul's School to the boiler house is about 1,600 feet, and that from St. Mary's to the boiler house about 1,700 feet.

The object of the reconstruction of the plant was for the purpose of saving fuel, and a test of the plant, since its completion, has fulfilled in every respect the stipulated requirements.

CONDITIONS UNDER WHICH WORK WAS PLANNED

Among the conditions imposed were: 1. The perfect construction of the tunnels to avoid dampness. 2. The perfect insulation of all the piping and fittings in tunnel. 3. The return to the boiler house of all the waters of condensation from every source. 4. Proper alignment of supply and return pipes to afford perfect drainage of a system back to the boiler house with free, dry and active circulation throughout the length of the steam pipes. 5. Provisions for expansion and contraction of piping. 6. Providing for proper circulation with no bleeds or drain at any part of system except at the terminating point in pump house. 7. Providing for a positive delivery into each building, except St. Paul's School, of the required amount of steam at a maximum pressure of five pounds per square inch inside the reducing valves, and the return of the condensation from each of these buildings back to the receiving tank in the pump room, without any connection to cess pool, sewer or drain, of which there had previously been many.

CONSTRUCTION OF TUNNELS

The miniature tunnels, to carry the piping, were constructed according to the cross-section plan, of Portland cement concrete. The grades of these tunnels, in all cases, are up from the boiler house to their extreme end. This upward grade was maintained accurately, the

highest being one foot from the surface of the ground. They are absolutely water tight.

Openings were cut in the foundation walls of each building, of the interior sides of the tunnel, and the bottom of the tunnel throughout its entire length was lined with hard-finished cement. Junction boxes are provided at intervals and are large enough to admit workmen.

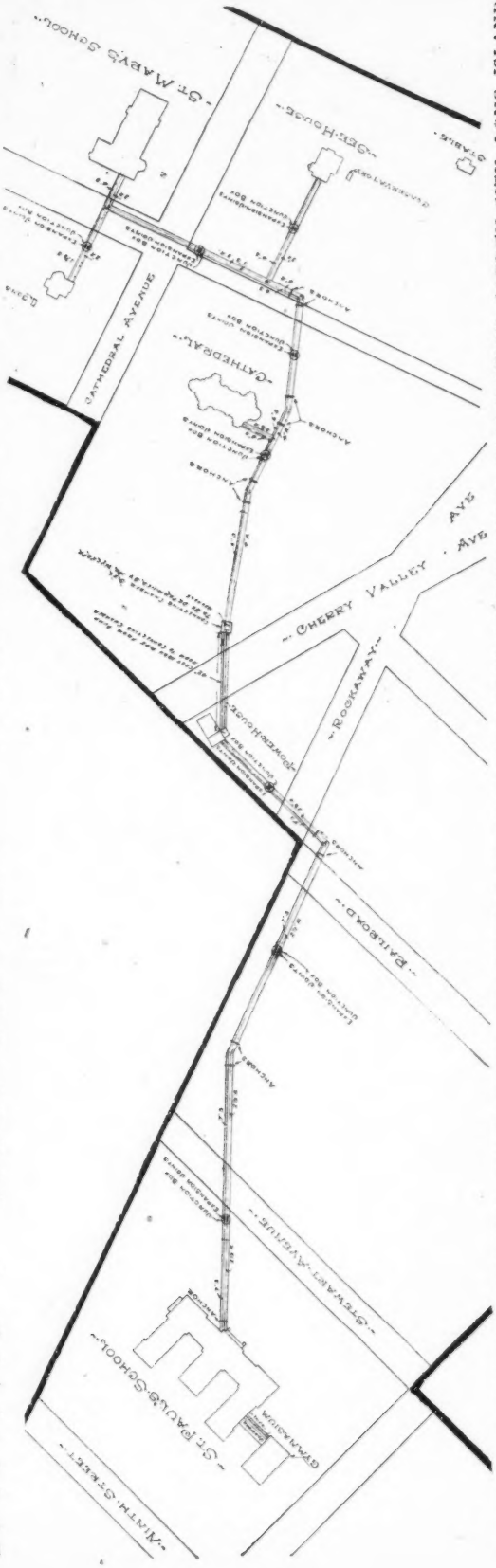
By the arrangement of the tunnels, the general grade of the return line is always down to the boiler house, making the system really act as a gravity return system, for it is not subjected to any undue pressure. Where intermediate drips were found necessary to insure a quick, dry and accurate circulation through the mains, automatic Bundy traps were applied to each of these drips in the tunnels or junction boxes, discharging into the gravity return. All pipes and tunnels were covered with one thickness of one-inch magnesia covering and extra canvas for protection against dampness.

NEW EQUIPMENT IN PUMP ROOM

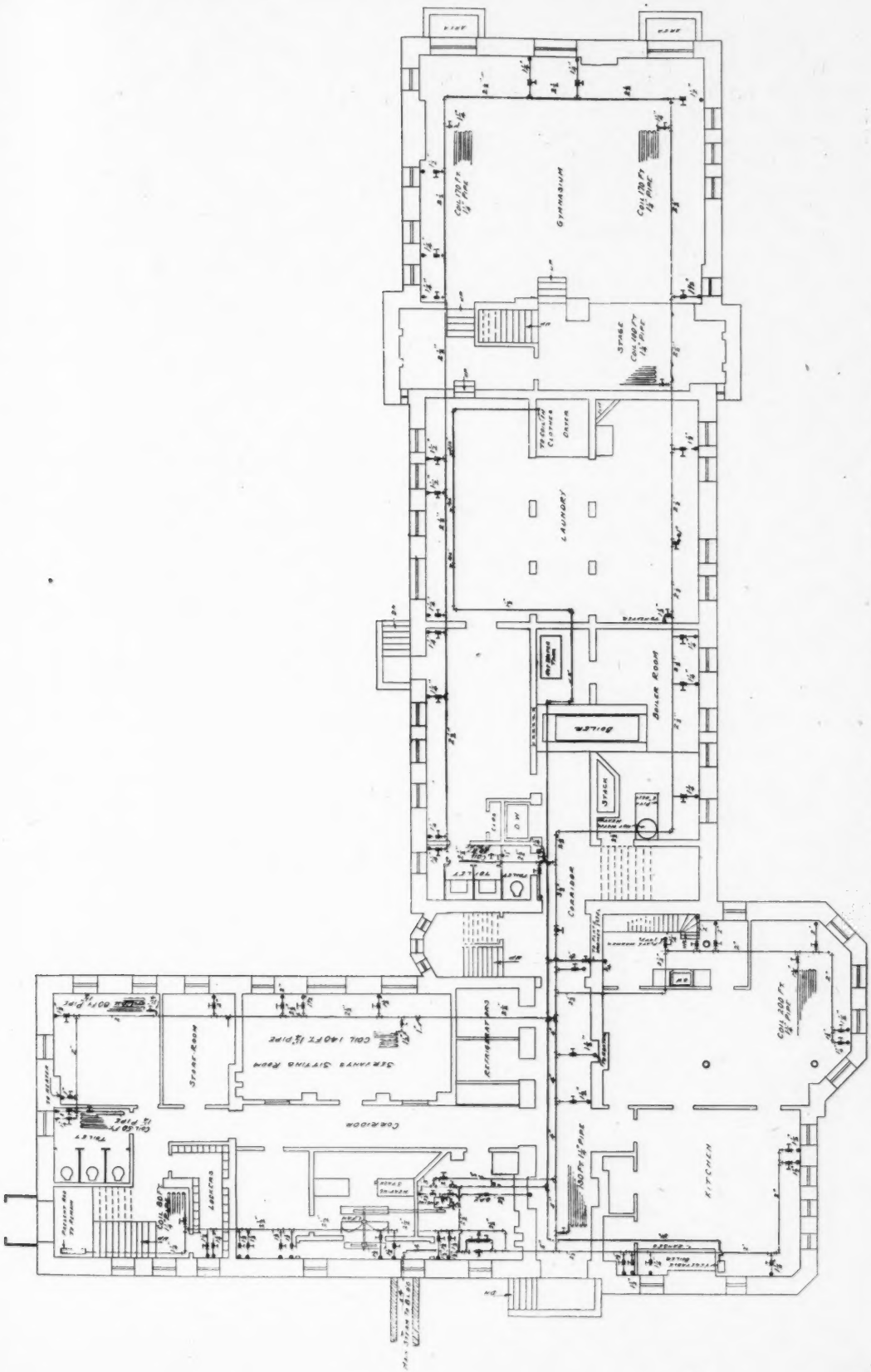
In the new pump room are located the new pump and old boiler feed pumps, governor, tank, feed water heater and filter. The receiving tank is 4 feet in diameter by 8 feet long, and the new pumps 7½ x 4½ x 6 inches, which was added to the two 6 x 4 x 6 inch pumps that were removed from the boiler room to the new position. The feed-water heater is made up of two 250 H. P. Berryman heaters connected to the main exhaust pipe in tandem, so that each heater may be cut out for repairs.

RECONSTRUCTING THE PIPING IN ST. PAUL'S SCHOOL

A remodeling of the piping in the basement of the St. Paul's school building included an enlargement of the mains and branches with drips, together with the renewing of an entire section of the return pipe that crossed from one wing to another in the court yard, bringing this return around through



BLOCK PLAN SHOWING BUILDINGS, POWER HOUSE AND TUNNEL LINES ON PROPERTY OF CATHEDRAL CORPORATION, GARDEN CITY, LONG ISLAND


GYMNASIUM
LAUNDRY
BOILER ROOM
BOILER
CORRIDOR
KITCHEN
STEAM
STORE ROOM
SERVANTS SITTING ROOM
COAL 140 FT 1½ PIPE
COAL 200 FT 1½ PIPE
COAL 100 FT 1½ PIPE
COAL 80 FT 1½ PIPE
COAL 60 FT 1½ PIPE
COAL 80 FT
COAL 100 FT 1½ PIPE
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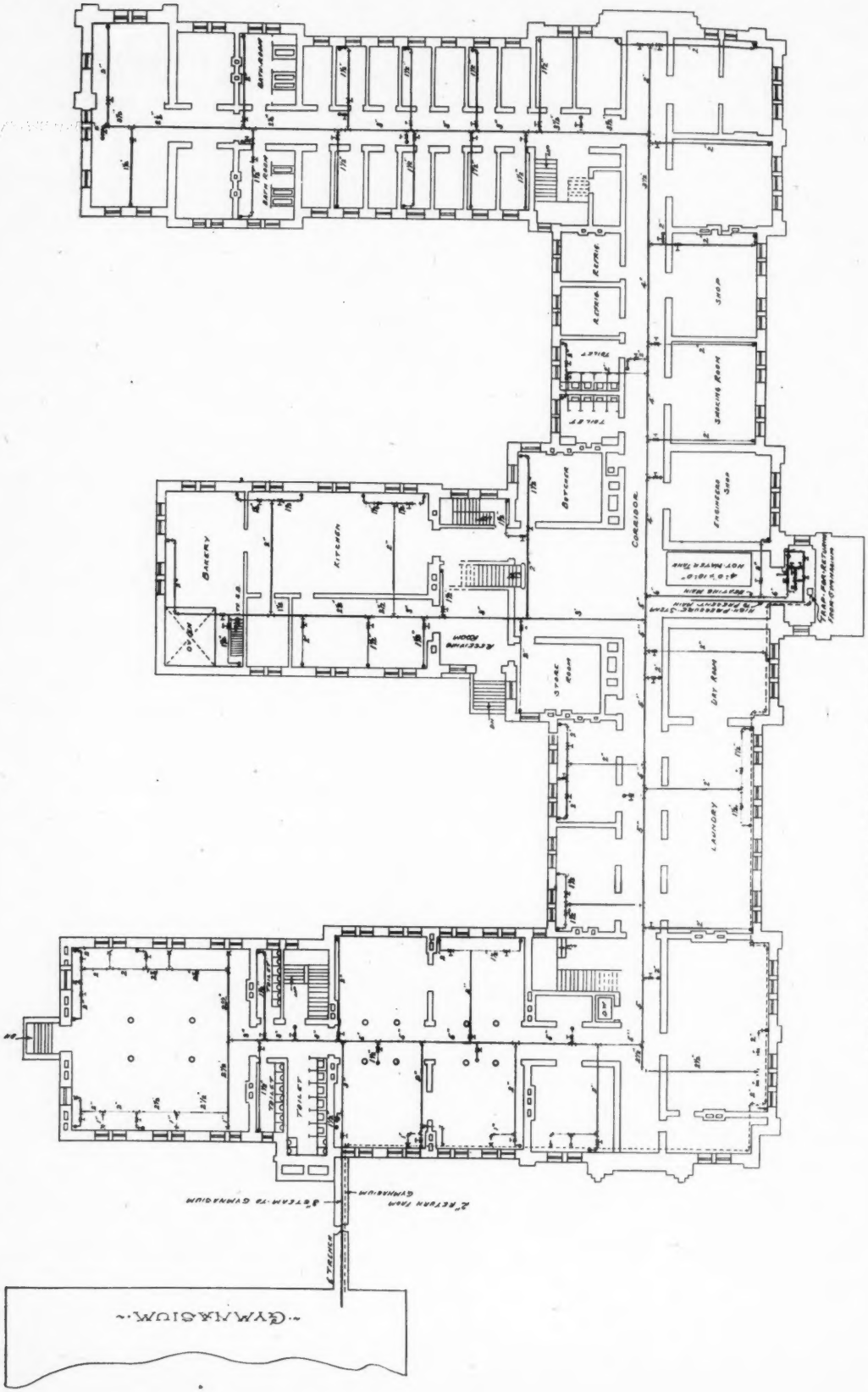
COAL 100 FT 1½ PIPE

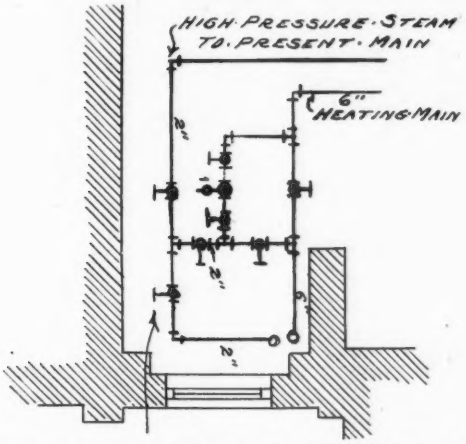


STEAM PIPING IN BASEMENT OF ST. PAUL'S SCHOOL, GARDEN CITY, L. I.

the basement of the building and discarding its previous underground position. As a result of this remodeling, a new system of steam and return mains and branches were installed, connecting with each radiator riser and with the other fixtures that had been supplied with steam. The apparatus is arranged to operate under one pound pressure, at which all the water is returned through traps and discharged into the underground main return.

INSUFFICIENT RADIATION IN GYMNASIUM

The heating surface throughout the building was sufficient, but in the gymnasium the surface had to be increased to some extent. For this purpose, a trench was built of smaller size than the regular tunnel for the accommodation of the piping leading to this building, including the hot and cold water supply. The return pipe from the gymnasium is brought back through the trench, but is carried around separately from the return in the school building, on the side wall to the tunnel opening, where it is provided with its own independent trap by means of a separate steam valve. In the west wing, the heating system in the gymnasium can be cut off without affecting the apparatus in St. Paul's school.



DETAILS OF BY-PASS CONNECTIONS AT POINT OF ENTRANCE OF STEAM PIPES TO ST. PAUL'S SCHOOL BUILDING

HOT WATER SUPPLY IN ST. PAUL'S SCHOOL

For the purpose of supplying hot water for domestic use throughout St. Paul's School, an additional tank, 4 feet in diameter and 10 feet long, was set up alongside of a tank previously used. The water in both tanks is heated by the exhaust steam from the pump, which immediately joins the tanks, and the connections are so made that the coils in each tank may be supplied independently or both operated at the same time. This pump, as well as the laundry engine, laundry fixtures and kitchen fixtures, are all operated through a separate high-pressure steam pipe, which runs through the tunnel from the boiler house.

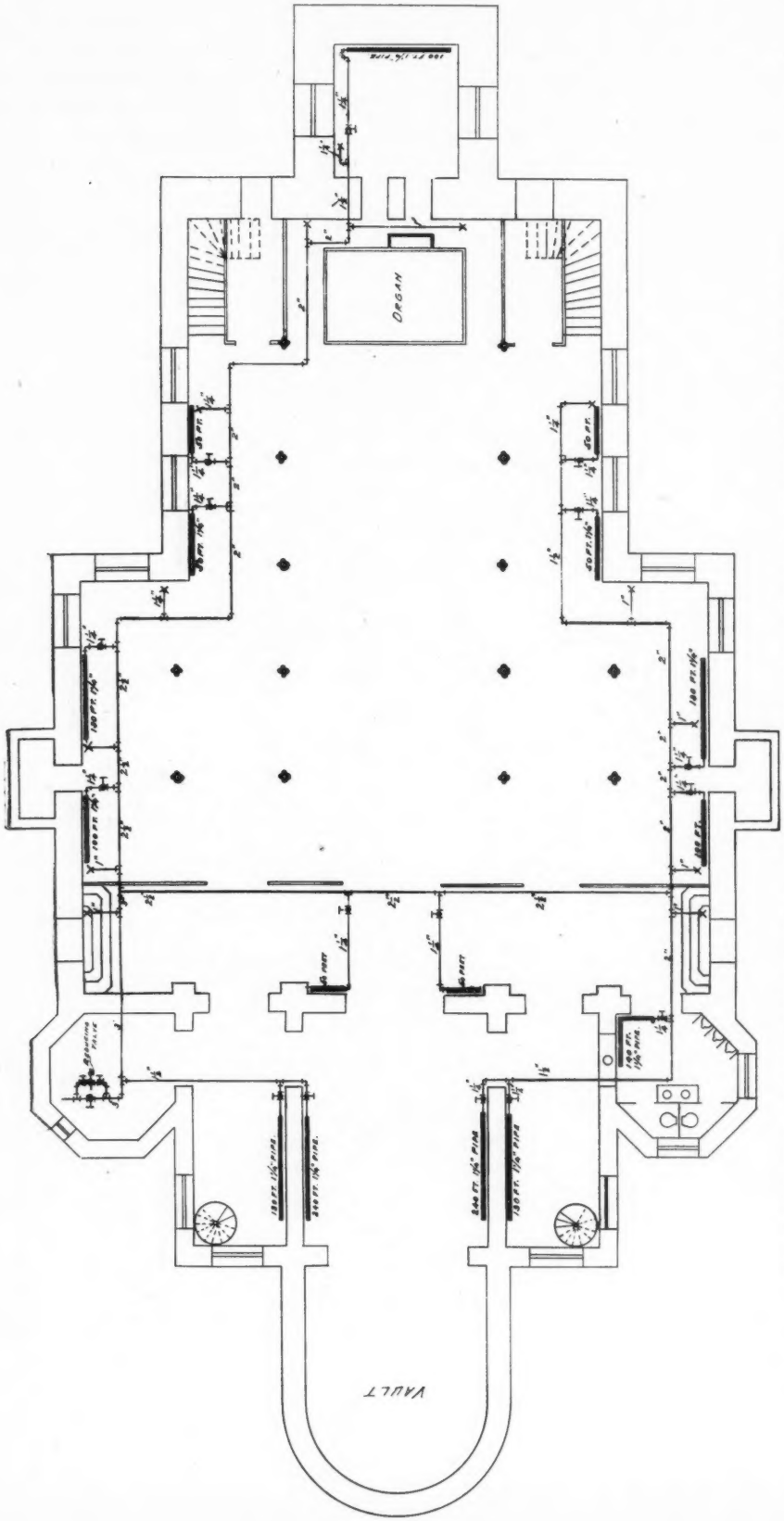
The tank in St. Paul's School supplies the fresh water to the boilers in the boiler house through 1¼-inch galvanized iron pipe, which runs through the tunnel and enters the new pump room. It is there connected to the pumps with a valve at each pump, so that the pumps may draw from this supply for fresh water for the boilers and other uses.

NEW PIPING IN THE CATHEDRAL

In the Cathedral, also, all of the heating fixtures in the basement or crypt floor were entirely disconnected and a new system of piping installed. A steam main enters the Cathedral at the point shown on the plans, and supplies the various radiators and coils, under one pound pressure. It will be noticed that the basement is heated mainly by close return bend coils placed on the side walls. These are made up of 1¼-inch pipe, which, with the exposed mains and branches, supply the necessary radiation.

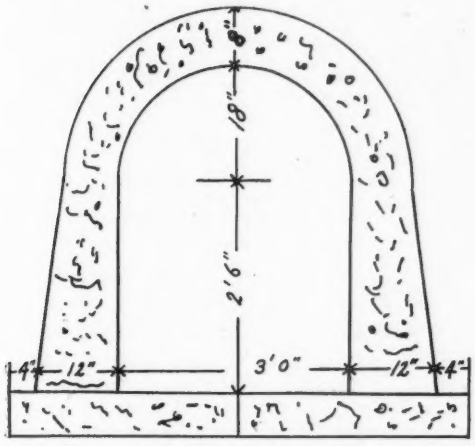
ALTERATIONS IN THE SEE HOUSE

In this building it was necessary to discard the underground return pipes and run an entire new system of return mains and branches to take the place of the hidden pipes. These returns were provided with a trap at the mouth



PLAN OF PIPING IN BASEMENT OF CATHEDRAL OF THE INCARNATION, GARDEN CITY, LONG ISLAND

opening of the new tunnel and connected into the new outside gravity return. The See House was equipped with the Holly system, so that under the new arrangement this had to be disconnected and the



SECTION THROUGH CONCRETE TUNNEL

dead end of the steam leads properly dripped.

STEAM SUPPLY TO GREENHOUSE CUT OFF

The old steam supply which led to the greenhouse was cut out and plugged in the basement of the main building, and, instead of supplying the greenhouse with high-pressure steam, there was built in a brick pit within the greenhouse a vertical cast-iron hot water heater. This heater was connected to a system of coils already in place in the greenhouse.

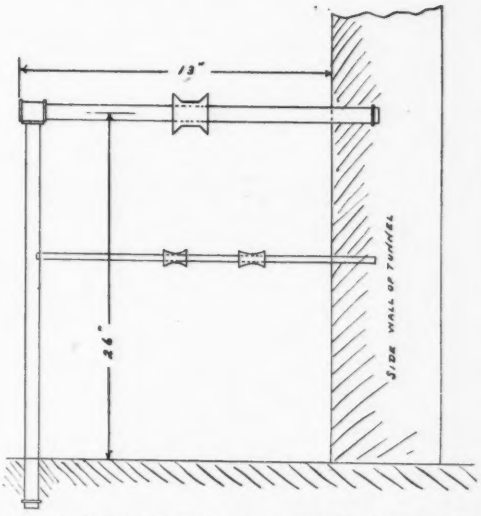
ALTERATIONS IN THE DEAN'S RESIDENCE

Among the alterations in this building were the addition of four radiators, one each in the pantry, laundry, study and kitchen. The steam supply is taken from the main which had previously supplied indirect radiators in the cellar. Return connections are taken from each radiator and connected into the main return in order to permit the radiators to circulate under one pound pressure. The old returns from the stacks in the cellar were enlarged to 1½ inches. A tank located in the cellar, used for heating the conservatory, was discarded and the sewer and steam openings plugged. A separate hot-water heater was installed in the conservatory.

REMODELING OF APPARATUS IN ST. MARY'S SCHOOL BUILDING

The equipment of this building, consisting of low-pressure heating mains and returns and high-pressure steam mains, located in the basement and beneath the floor of the basement, were practically all removed and a new system of high and low pressure piping installed to fulfil the conditions for a proper circulation throughout the building under one pound pressure and to return all the water of condensation directly to one central point at the entrance of the tunnel on the north end of the building without any bleeds or other drain connections to sewer or cesspool.

The radiation for this building was found to be ample except in



METHOD OF SUPPORTING PIPES IN TUNNEL

that portion of the building lying south of the new north wing. This was therefore enlarged accordingly.

REARRANGEMENT OF HOT-WATER HEATERS

A rearrangement was also made of the hot-water heaters in the building. A heater located in the engine room was reset so as to enable the water of condensation from

its steam jacket to be returned through a trap into the new outside return main. A new hot-water tank was provided to take the place of an old tank, located in the room adjoining the boiler room in the old building. This new tank has a capacity of 300 gallons. A direct steam supply is taken from the outside of the main reducing valve and connected with both hot-water heaters, so that these heaters may be supplied with steam independent of the heating system. Each tank is properly valved for individual control. Branches are taken from the same line, connecting as previously with the laundry fixtures, and having a separate steam and return main from the hot-water tanks and drying room coil. This high-pressure line is brought to the mouth of the opening tunnel in a trench beneath the corridor and there trapped. An engine, which was located in the engine room, was disconnected entirely from the service.

IRON TUBE REPLACES PART OF TUNNEL

At one point in the line of the tunnel, on the east side of Cherry Valley avenue, there is an abrupt rise in the grade for a distance of about 200 feet, at the bottom of which is a running stream. Here the successful expedient was resorted to of using, instead of the concrete tunnel, a 48-inch tube of boiler iron, composed of a number of lengths. The tube connects with the pump house and runs to the starting point of the miniature tunnel at the brow of the hill. There are no manholes in this tube, as access to it is had through its mouth opening within the wall of the pump pit and through Junction Box No. 1 on the Cathedral line.

Where the new tunnel passes through the foundation walls of the various buildings, there is provided a heavy mesh gate.

The reconstruction of the entire system for this central power heating plant was designed and installed by Blake & Williams, of New York.

Heating and Ventilating the New Montauk Theater, Brooklyn, New York

A Recent Type of Upward Ventilation

Advocates of the upward system of ventilation for meeting rooms and other auditoriums will find much to interest them in the heating and ventilating plant designed for the New Montauk Theater, in Brooklyn, and recently completed. It represents, perhaps, as well as any ventilating system that he has planned, the ideas of the consulting engineer, Prof. Wm. J. Baldwin, as to the preference of upward over downward ventilation in buildings of this character.

The heating of the auditorium proper is taken care of entirely by means of indirect radiation, but in the main entrance halls and in the foyer on the second floor direct radiation is used. In addition, the halls and main entrance on the first floor are supplied with indirect radiation from the plenum when the fan is in operation, which passes through secondary heaters, so as to supply a large quantity of warm air at the entrance and secure an outward flow of air at the doors, or at least neutralize the effect of the cold air that is likely to enter at the outer doors during the rush hours.

ENTIRE SPACE BENEATH AUDITORIUM A PLENUM CHAMBER

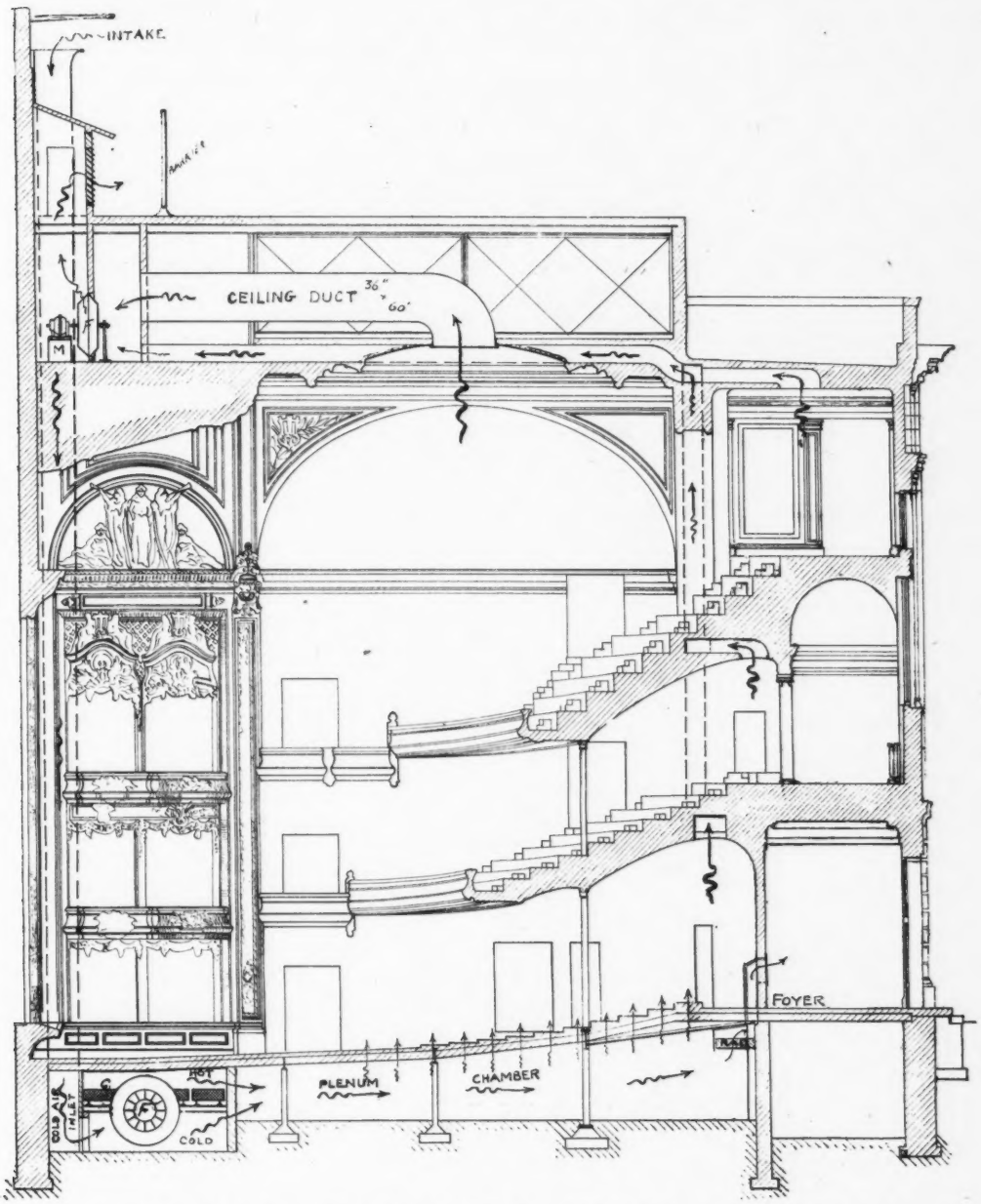
In the Montauk Theater, practically the entire space beneath the orchestra floor is a plenum chamber. From this chamber 700 openings, under as many orchestra chairs, admit the heated air, which rises to the ceiling and is there exhausted through a large ceiling

duct, by means of an exhaust fan located directly under the roof.

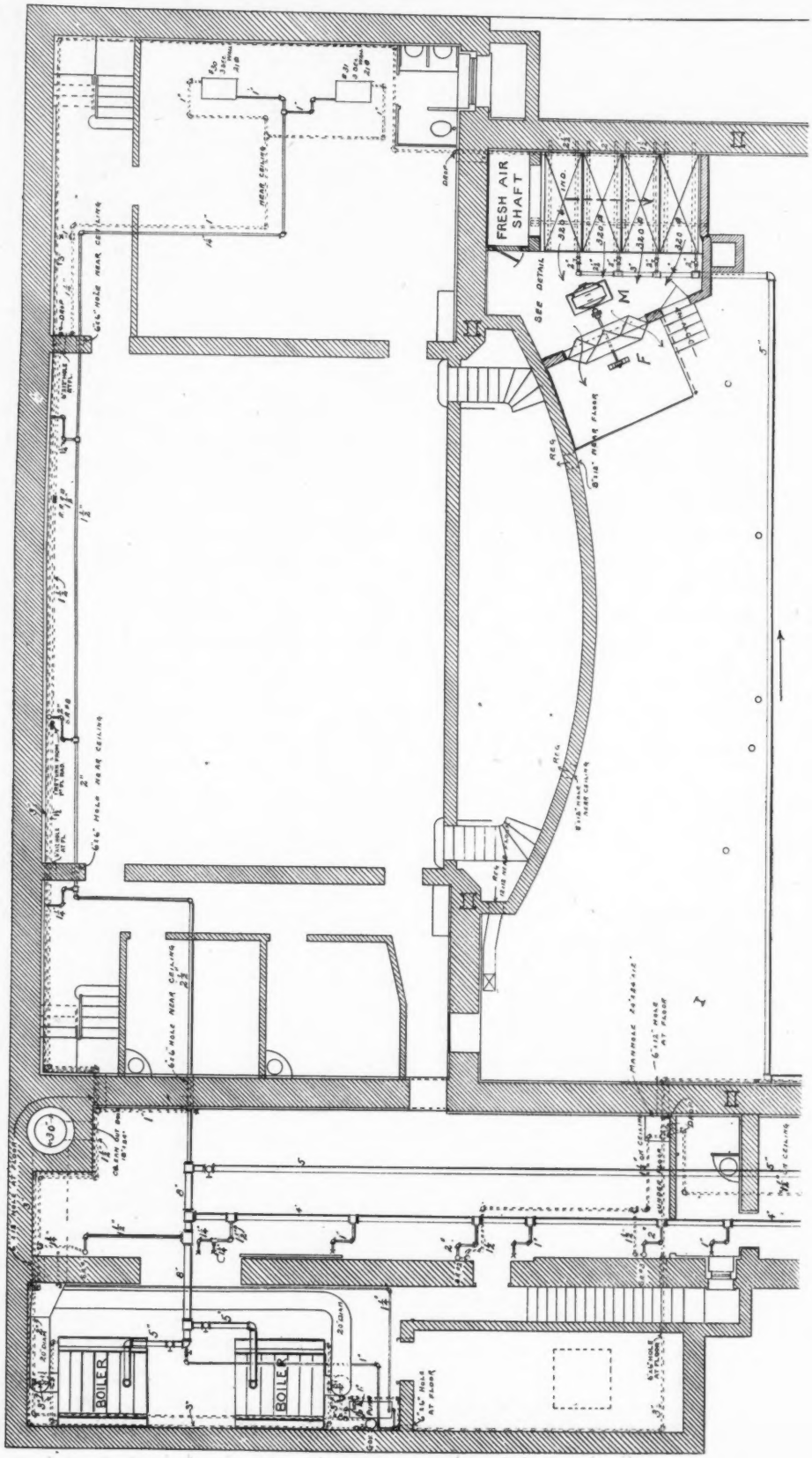
The stage is not shown in the sectional view. The feature of its treatment is the use of a large quantity of heating surface in the upper part of the flies underneath the roof, so as to warm the air at the highest point and keep it there.

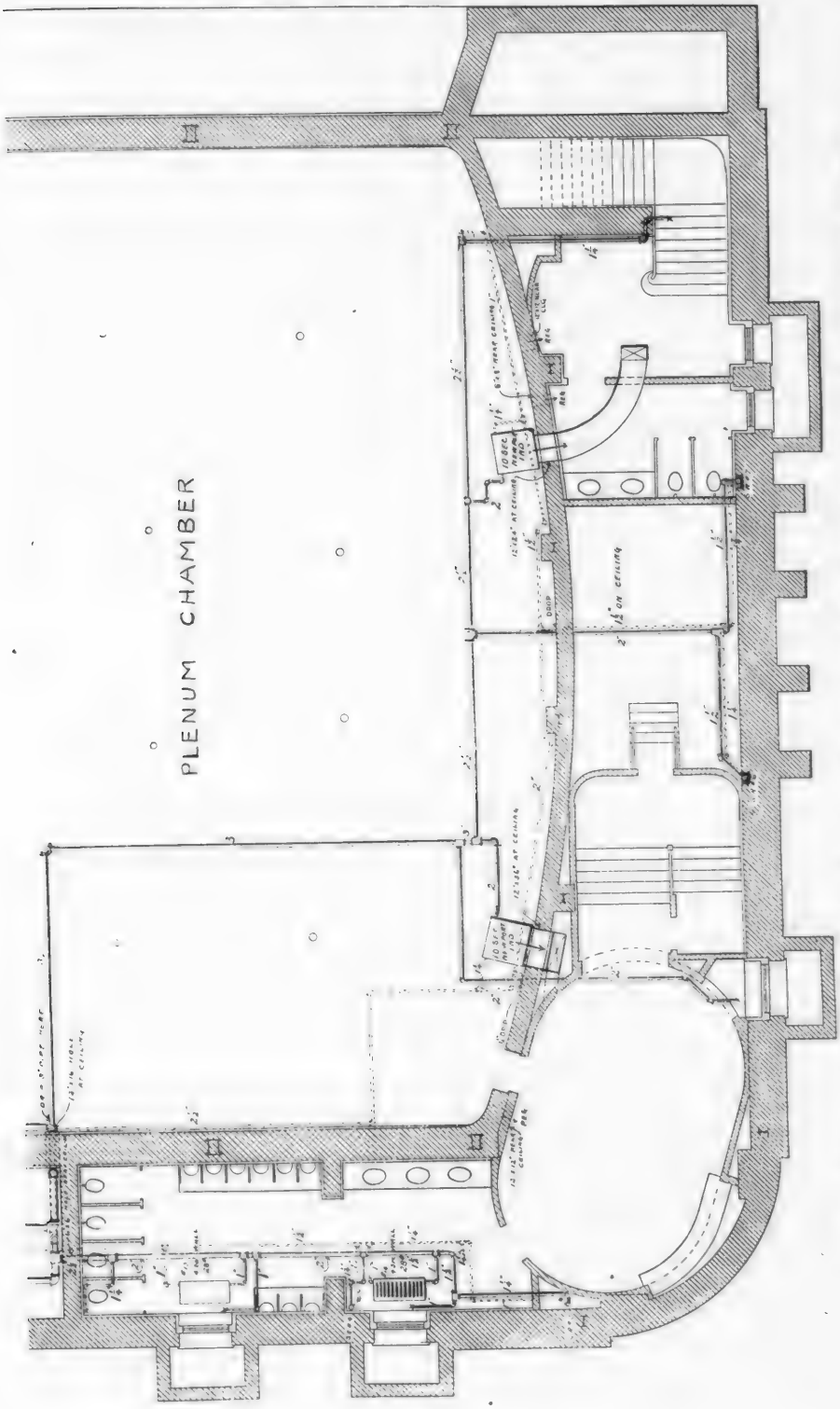
MECHANICAL EQUIPMENT

Two Gurney water tube boilers, of about 50 H. P. each, supply steam for the various heaters of the building, which includes, besides those shown on the plan, a few direct radiators and also some wall coils above the stage to take care of the skylight at that point.



SECTIONAL VIEW, NEW MONTAUK THEATER, BROOKLYN, N. Y., SHOWING VENTILATING SYSTEM


FRESH AIR SHAFT
SEE DETAIL
BOILER
BOILER



PLAN OF BASEMENT, NEW MONTAUK THEATER, BROOKLYN, N. Y., SHOWING LAYOUT OF HEATING SYSTEM

The tempering coil for the heating of the auditorium is made up of 1,200 feet of direct heating surface, divided into a series of sections so set as to allow for proper air area. These sections are so connected that one or more may be closed off without shutting down the balance. The water of condensation from this coil is returned to the boiler by means of a pump located in the boiler room.

Fresh air is taken through a flue from the roof, and is conducted through the tempering coil and thence forced into the space in the basement below the auditorium. It is carried upwards from this point through adjustable caps placed below each seat in the auditorium. These inlet caps are of cast iron, three inches in diameter, and are adjustable, so that, if the occupant of the chair immediately over it knows how and is aware of the opportunity, he may partly but not entirely shut off the air supply for that seat.

The pressure fan for supplying the tempered air is designed to discharge one million cubic feet of air per hour when running at a velocity of 250 revolutions per minute, against a half-ounce pressure. This fan is driven by a direct-connected electric motor with a variation of five speeds.

From the plenum chamber, at several points under the auditorium, galvanized iron heat ducts are carried into rooms in the basement, including smoking room, ladies' reception room and orchestra pit.

EXHAUST VENTILATION

An 84-inch fan takes care of the exhaust ventilation. This fan is equipped with a direct-connected motor, and is of practically the same design and size as that used in the plenum chamber. The two vertical vent flues, leading from the balconies, are connected near the roof space into ducts which carry the vitiated air to the vent fan. Another duct, 36 x 60 inches, runs from the main auditorium roof to the vent fan. The ducts and flues, ventilating the dressing rooms, toilet rooms and smoking room, are all connected to the main vertical vent flues.

ENTIRE SYSTEM THERMOSTATICALLY CONTROLLED

The entire system is thermostatically controlled by means of three thermostats controlling four diaphragm steam valves. There is one thermostat in the auditorium, which controls two diaphragm valves on the main sections of the heater. Another thermostat is placed in a cold-air duct to control the heater on the cold-air side, and a third thermostat is placed in the plenum chamber in connection with a thermostatic relay to control the same valves as are operated by the thermostat in the auditorium of the theater.

The operation of the two thermostats is such that when the thermostat in the auditorium calls for heat, the valves remain open on the main section of the heater until the temperature of the theater has reached the desired point, when the valves will close.

When the temperature in the plenum chamber falls below 68 degrees, the thermostat will open the steam valves at once to control the temperature of the air in the plenum chamber at that degree, thus maintaining in the auditorium, either hot air for purposes of warming, or tempered air for ventilation. The system was designed by Mr. William J. Baldwin, of New York.

Annual Meeting of American Foundrymen's Association

Announcement has been made of the tenth convention of the American Foundrymen's Association, to be held in Cleveland, Ohio, June 5, 6 and 7, 1906.

An attractive series of papers has been promised.

Cleveland is well-known as the great foundry center of Lake Erie and the interest being taken by the foundry and manufacturing interests of the city in the forthcoming convention will go far to insure its success.

Unwholesome Air in Dwellings*

Heating and Lighting Apparatus Shown to Be Responsible for Much of the Bad Air in the Modern Home

By Albert-Levy,

Chemical Director at the Municipal Experiment Station of Montsouris, France.

Translated for The Heating and Ventilating Magazine

At the International Tuberculosis Congress, held at Paris last October, I was able to point out a new source of unwholesomeness in our dwellings by proving, by a large number of experiments, that carbon oxide even in traces causes very marked ailments, and surely and fatally brings on a progressive anemia that weakens resistance to disease.

I wish now to note some new facts which interest not only the physician, but the engineer, the architect and the hygienist.

OXICARBON INTOXICATION

At the congress referred to, M. Juillerat and Bonnier called particular attention to what they termed "oxicarbon intoxication." "The occupants of a room," they said, "otherwise comfortable, are often attacked by vertigo; their digestion fails; they have headaches, a sense of drowsiness, giddiness and nausea. They lose appetite and grow weak.

"On consulting a physician, this morbid condition, that yields to no treatment, is ascribed to overwork, to insufficient nourishment, to an organic disease of the stomach or nervous disorder; and no improvement is shown short of a change of air in the country.

"In the majority of cases we have purely and simply a feeble carbonic intoxication, not enough to bring on death, but sufficient to seriously endanger health.

DEFECTIVE HEATING APPARATUS AT FAULT

"One of the least noticeable faults of the ordinary dwelling is found in defective heating apparatus, especially in the flues for the discharge of the products of combustion. The use of apparatus for slow combustion is certainly one of the worst causes of intoxication. In Paris, since the Municipal Council, eight years ago, gave us the means of testing smoke pipes, we have learned that more than two-thirds of them are dangerous and expose the inmates of houses to the fatal consequences of oxicarbon intoxication. The anemia resulting from this imperceptible poisoning is one of the most dangerous causes, predisposing to tuberculosis infection because, in most cases, it is extremely difficult to detect and fight."

I desire for my part to note the unsanitary air that we breathe in our houses, in our schools and in our workshops. When this air contains toxic gases, even in traces, it poisons; when it contains an abnormal proportion of carbon dioxide it asphyxiates from a deficiency of oxygen.

CARBON OXIDE CANNOT BE DETECTED BY ORDINARY MEANS.

Carbon oxide is a toxic gas, the fatal action of which has long been known. This toxic gas is found almost constantly, in small proportions, it is true, in a great number of our dwellings, and it is all the more to be dreaded, as nothing warns us of its presence, and the intoxication is progressive. Doctor Dumonet makes the observation that "the intoxicated are in complete ignorance of their condition. They can leave the room where they suffer, breathe pure air and return to expose themselves again to the causes of intoxication without being aware of them. They are in a torpid condition, not far from the dead point, if the carbon oxide continues to contaminate the atmosphere."

*From La Technique Sanitaire.

SOURCE OF CARBON OXIDE IN HEATING AND LIGHTING SYSTEMS.

What is the source of this carbon oxide? It is the defective heating and lighting systems we employ in our dwellings.

With my assistant, M. Pécoul, I have made a study of the products of the combustion of the different combustibles used in heating and lighting. We used the following apparatus:

APPARATUS USED IN EXPERIMENTS

A zinc cylinder 5¼ feet in height and 20 inches in diameter, cylindro-conical in shape, was supplied with tubes which could be closed and which were in use only at the beginning of the test, when we wished to ventilate the apparatus. A chamber of 10 in. diameter could also be hermetically closed by a jointed glass plate.

METHOD OF MAKING TEST

Before making an experiment, the reservoir was aired for five minutes with a ventilator giving 70 cubic feet of air per minute, fixed on one of the tubes, the chamber being closed. Having found that the cylinder was entirely free from the gases it contained, and that its atmosphere was then absolutely similar to that of the surrounding air, the chamber being open and all the other tubes closed, we placed on the lower face of the cylinder the source of heat to be tested. The warm gases of combustion would rise in the cylinder, mix with the air it contained, enriching it more and more with the gases of combustion. The purpose of the chamber was to furnish, by its lower portion, the atmospheric air necessary for this combustion, the excess of the burned gases escaping through the upper portion of the chamber.

FEATURES OF THE TEST

In all our experiments, after five hours of action, the gases which had accumulated in the upper part of the chamber ceased to increase in carbon dioxide. Two analyses made at intervals of half an hour gave the same result. At this moment, without stopping the combustion, one cubic foot of the gas was slowly collected in a caoutchouc bag. We made sure, during this process, that the upper part of the chamber showed a constant current from the interior toward the exterior.

Such were the conditions which we maintained uniformly, approximating as much as possible the normal conditions of the working of the apparatus subjected to this test.

SOME OF THE RESULTS OBTAINED

The following are some of the results obtained:

	Carbon Oxide in Hundred-Thousandths	Carbon Dioxide in Thousandths	Consumption by the Hour
Air of the laboratory	0.0	0.6	
Stearic candles	Traces.	5.0	1.35 ounces
Kerosene lamp	Traces.	23.4	0.84 ounces
Alcohol lamp	3.2	7.3	2.03 ounces
Formogene lamp	85.0	8.8	2.16 ounces
Gas, white flame (ordinary burner)	1.2	7.0	5.29 cu. ft.
Gas, blue flame (Bunsen burner)	0.0	11.0	7.06 cu. ft.
Gas, blue flame (incandescent, with mantle)	1.4	16.0	4.06 cu. ft.
Gas, blue flame (incandescent, without mantle)	1.3	15.0	4.06 cu. ft.
Gas, blue flame (heating burner with support)	2.8	11.0	4.06 cu. ft.

RESULTS OBTAINED IN A TEST OF FUELS TO DETERMINE RELATIVE QUANTITIES OF CARBON OXIDE AND CARBON DIOXIDE GIVEN OFF DURING COMBUSTION.

In the four last experiments on the combustion of gas with a blue flame, only the proportion of air drawn varies, and we note that when this proportion of air increases, the carbon dioxide remains almost sensibly constant, while the carbon oxide increases to double its proportion.

This result deserves to be confirmed by special experiments.

We took an incandescent burner, free from its mantle, and made it burn in our experiment room, first by opening wide all the openings for air, then by limiting them to one-quarter. The consumption of gas was uniformly 4.04 cubic feet an hour. Here are the results obtained:

	Carbon Oxide in Hundred-Thousandths	Carbon Dioxide in Thousandths
First experiment..... (totally open)	1.2	16
Second experiment..... (half open)	0.5	16
Third experiment..... (quarter open)	0.3	16

TEST OF COOK-STOVE BURNER

The following are other proofs of the same fact:

A cook stove, of the model of those supplied by gas companies to their patrons, was lighted in a closed room. The admission of air in this apparatus was plainly too large, the jets of the flame were small, blue and made an abnormal hissing noise. Our apparatus gave us a corresponding indication of about two hundred thousandths. We regulated the stove, that is to say, by a ring we diminished the admission of air. The flame was lengthened, became less blue and was quiet. There was no longer a trace of carbon oxide. These trials, repeated several times, always gave the same results.

We can say then that under the conditions of our experiments, the production of carbon oxide increases when we introduce in the blue flames a quantity of air increasing in volume.

EXPLANATIONS OF THE PHENOMENA

How shall we explain these phenomena? We might suppose at first that a too great inflow of air chills, momentarily, the flame, or else that this flow of air draws in carbon oxide not yet burned. We may suppose again that, at the elevated temperature of the flame, the carbon dioxide parts with one atom of oxygen, and carbon oxide is formed. The experiments of M. Féry have shown that the maximum temperature of a Bunsen burner is practically the same as that of a trellis burner, about 1,600 degrees. Only in the Bunsen it is scarcely one point of the flame that reaches this temperature, while in the other burners these points of maximum temperature are in much larger number. That might explain perhaps that there is a great dissociation with the trellis burner, but not a total absence of dissociation in the Bunsen burner.

HEATING AND LIGHTING APPARATUS GIVES CARBON OXIDE IN PROPORTION TO THE AMOUNT OF AIR ADMITTED.

Whatever may be the explanation of the phenomena, it is no less a fact, and that allows us to infer that these different apparatuses for heating and lighting give carbon oxide in quantity in proportion to the amount of air admitted. Since the different systems of heating and lighting always give, in more or less greater quantity, carbon oxide, it is not astonishing that we have found the presence of this gas in Paris school rooms and hospitals and in a great number of private dwellings.

EFFECT OF CARBON OXIDE ON THE BLOOD

It is impossible for us to say, in the actual state of the science, exactly how the hemoglobin of the blood acts under the action of the

carbon oxide. Claude Bernard used to say that "every globule charged with carbon oxide is a dead globule." Quinquand and Gréhant have shown that this theory is too absolute, and M. de Saint-Martin has proved that with a powerful current of oxygen we can transform the carbon oxide of the hemoglobin into carbon dioxide. But we cannot always be subjected to a powerful current of oxygen, and M. Brouardel informs us that one can be intoxicated by carbon oxide even in the open air.

What we are concerned with is that we have shown that in a room containing only one-hundred thousandth of carbon oxide a great number of persons complain of serious indispositions: headaches, vertigo, nausea, etc., which disappear, more or less rapidly, outdoors, to reappear when they enter the contaminated room again.

If it is true that an animal can endure without appreciable harm (and its impressions are unknown to us), an atmosphere lightly charged with carbon oxide, can we say that it is the same for a human being? Can we believe that a prolonged stay in a one-hundred thousandth of carbon oxide will cause no ailment, and will have no unpleasant consequences? If the cell is not dead, as Claude Bernard said, can we state that it has suffered no harm when the carbon oxide has disappeared?

TRACES OF CARBON OXIDE MUST BE AVOIDED

We can therefore affirm, notwithstanding all these unanswered questions, that we must avoid carbon oxide even in a state of trace. It is then necessary to discover the presence of traces of carbon oxide. That is the result afforded by the automatic apparatus which M. Pécoul and I have had constructed, an apparatus that reveals the presence of one-hundred thousandth of carbon oxide.

ALLOWANCE OF AIR FOR OCCUPANTS NOT SUFFICIENT

So far, attention has been given to the cubic amount of air that is necessary to have in every room for each occupant. This calculation is absolutely insufficient, first, because, in our opinion, not enough account is taken of the two elements of surface and height, which determine this cubic capacity and because respiration is not the same when a man lives in a room of 700 cubic feet, if this volume is obtained by multiplying a surface of 100 square feet by 7 feet of height, or by multiplying a surface of 24 square feet by 30 feet of height.

But this indication of volume is particularly insufficient, because this volume may be filled with air deficient in oxygen. When we speak of the volume necessary to respiration, we ought to add: volume of respirable air.

Our analyses, continued without interruption each day at the Observatory of Montsouris, have shown that normal atmospheric air contains a proportion of thirty hundred thousandths of carbon dioxide; one cubic foot of carbon dioxide in 3,500 cubic feet of air. This proportion increases progressively in a room where a certain number of persons are breathing, and it is admitted that, when it reaches one thousandth, the atmosphere is unwholesome, or at least poor. That is the maximum proportion that the labor inspectors permit in the workshops.

The necessity of noting frequently the proportion of carbon dioxide in a confined atmosphere led M. Pécoul and myself to construct a portable instrument, acting automatically and permitting the reading on a tube of the exact volume, almost to a ten-thousandth, of the carbon dioxide present in 3,500 cubic feet of air of the room under examination.

This determination will enable all those, having the moral responsibility of the health of a group of persons, to note, as frequently as they desire, the hygienic value of the apartments in use.

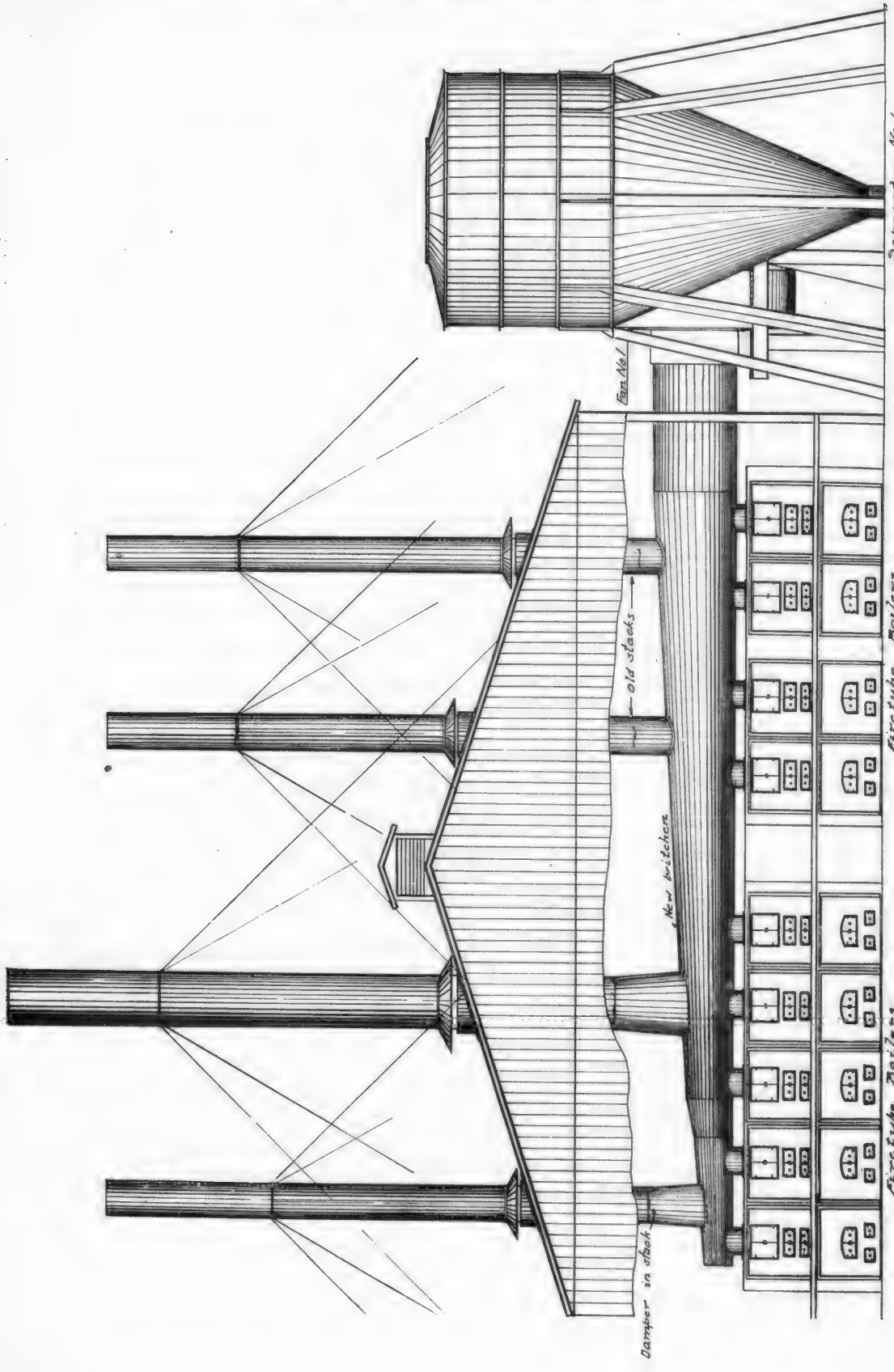
A Remarkable Induced Draft and Cinder Separating Plant

In Power House of the Portland Consolidated Railway Company, East Portland, Oregon

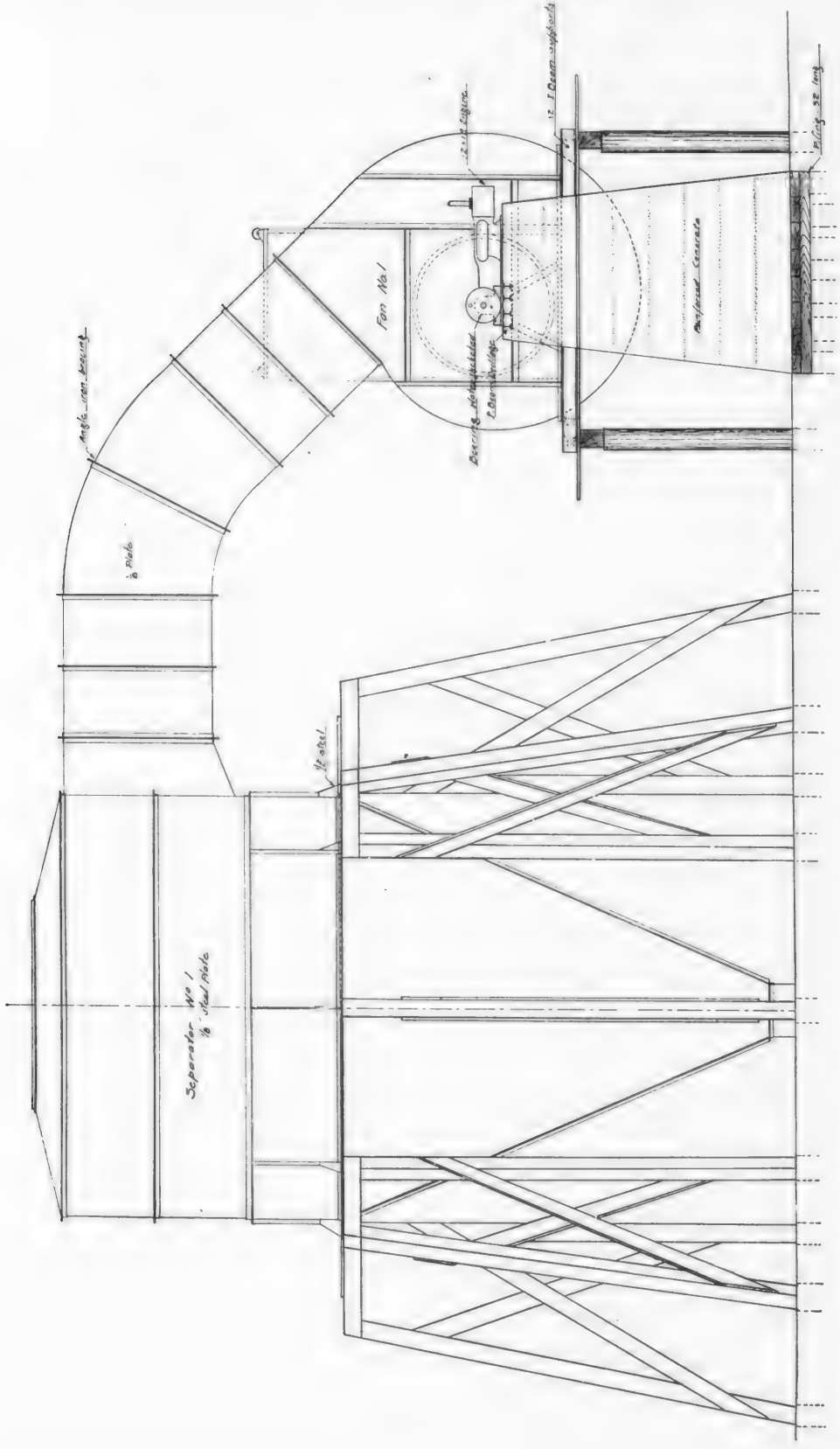
The plant described and illustrated in the following pages was installed with a view to doing away with the cinders which constantly belched forth from the stacks of the great boiler plant of the Portland Consolidated Railway Company. Residents within one-half mile of the plant had been troubled with cinders collecting on their sidewalks and porches, and ruining the clothes on the clothes lines. The Inman-Poulsen Lumber Company, whose mill adjoins the power plant, have had thousands of dollars' worth of lumber refused by inspectors on account of the fact that it was blackened in spots by these cinders.

This plant, which cost in the

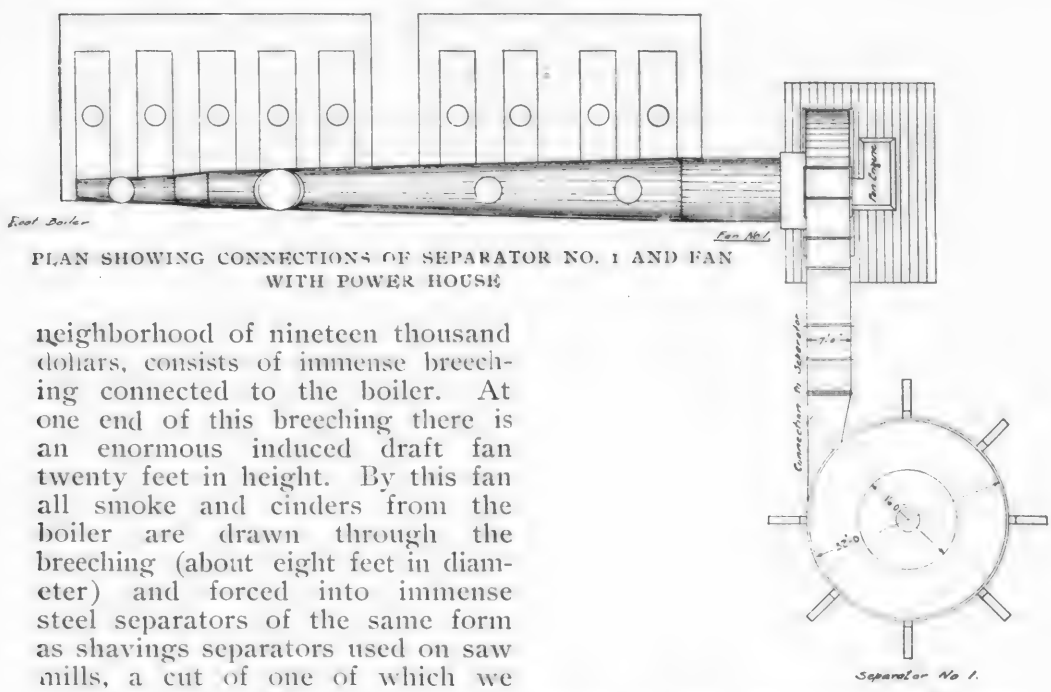
VIEW OF SEPARATOR No. 2, AS INSTALLED AT THE PLANT OF THE PORTLAND CONSOLIDATED RAILWAY COMPANY, EAST PORTLAND, OREGON



SECTION OF POWER HOUSE, SHOWING LOCATION OF SEPARATOR No. 1

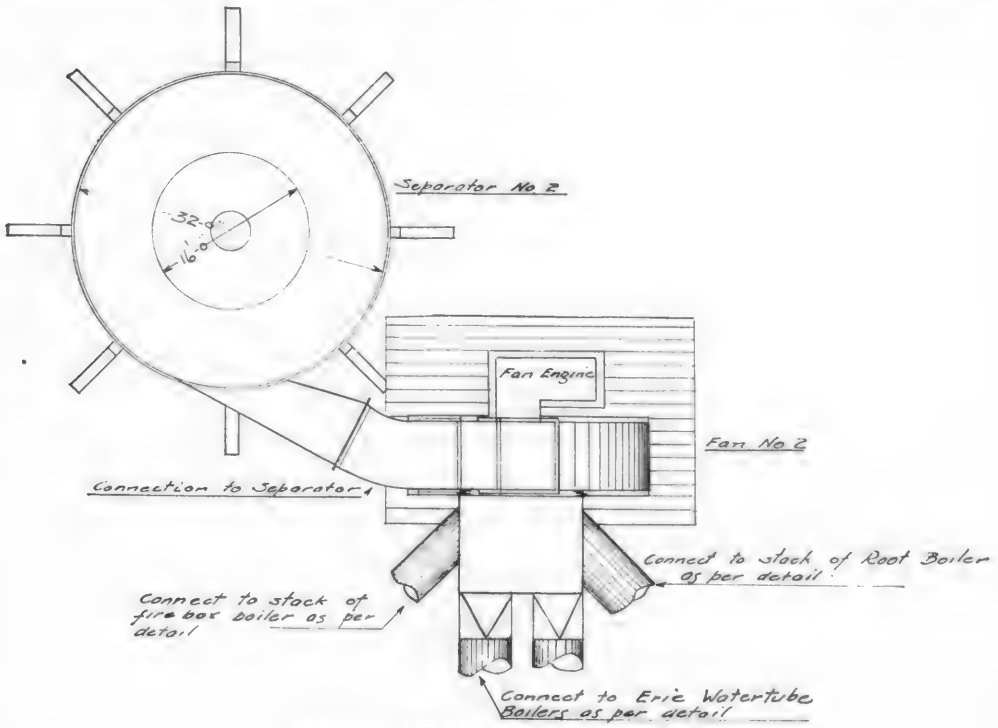


SECTIONAL VIEW OF SEPARATOR No. 1 AND FAN

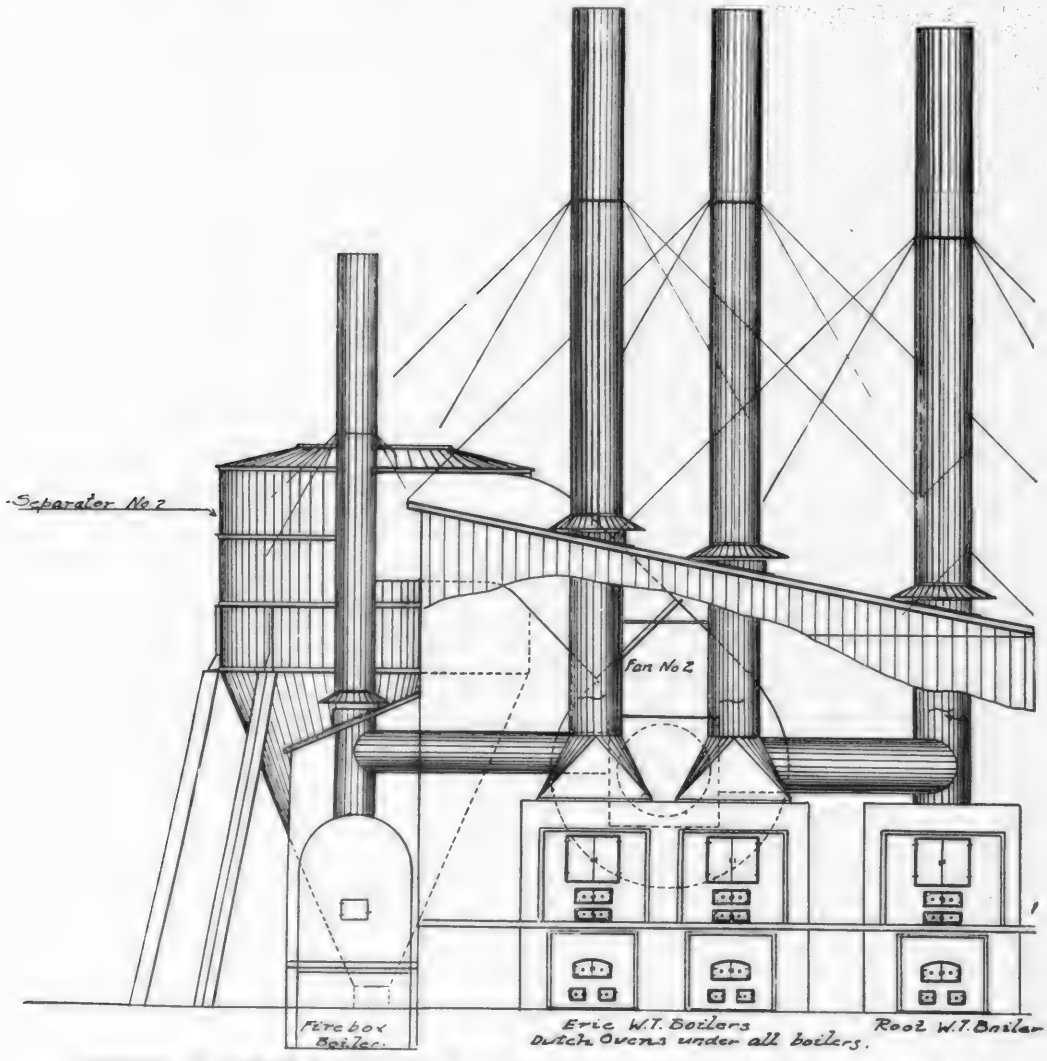


PLAN SHOWING CONNECTIONS OF SEPARATOR NO. 1 AND FAN WITH POWER HOUSE

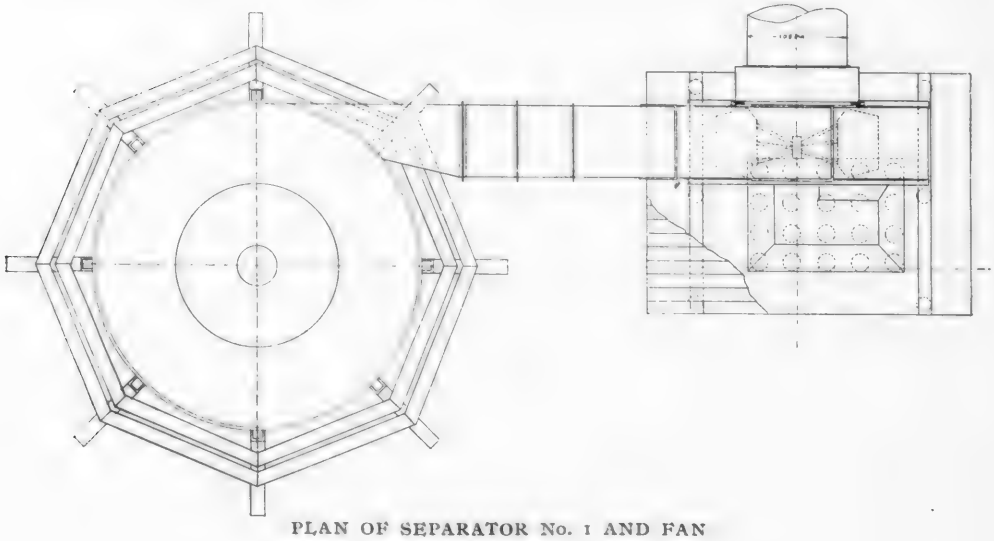
neighborhood of nineteen thousand dollars, consists of immense breeching connected to the boiler. At one end of this breeching there is an enormous induced draft fan twenty feet in height. By this fan all smoke and cinders from the boiler are drawn through the breeching (about eight feet in diameter) and forced into immense steel separators of the same form as shavings separators used on saw mills, a cut of one of which we show herewith. Due to the action of the fan, the smoke and cinders undergo on their entrance to the separator a whirling motion. The cinders, being heavy, gradually drop in a spiral path to the bottom of the separator, and from that point are conveyed by a steam driver conveyor to the boiler furnaces, there to be consumed. The smoke, at a comparatively low velocity, escapes through the top


Separator No 2
32'-0"
16'-0"
Fan Engine
Fan No 2
Connection to Separator 1
Connect to stock of Root Boiler as per detail
Connect to stock of fire box boiler as per detail
Connect to Erie Watertube Boilers as per detail

PLAN OF SEPARATOR NO 2 AND FAN



SECTION OF POWER HOUSE, SHOWING LOCATION OF SEPARATOR No. 2 AND FAN



PLAN OF SEPARATOR No. 1 AND FAN

of the separators into the open air.

Although the action of the separators has been watched by interested parties using strong field glasses, it has been impossible to perceive even with these the least vestige of cinder escaping with the smoke.

While economy in fuel was not a desideratum of the plant, it has been found since the installation that a marked increase of power was developed by the boilers.

Another advantage which has been impressively noticed by the operatives of the power plant has been the absolute uniformity of the draft obtained. The plant was installed by the W. G. McPherson Company, of Portland, Oregon.

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*Heating and Ventilation of St. Paul's Hospital, Montreal, Que.**

By Alan G. McAvity

It is the intention of this paper to describe a system of heating and ventilation at St. Paul's Hospital, Montreal; to outline the ideal aimed at; and to discuss the function and efficiency of the equipment installed.

IMPORTANCE OF HUMIDITY

An ideal system of heating and ventilation should maintain a constant temperature and supply fresh air in large quantities at a proper humidity without dust or drafts. Almost every system of heating is designed to maintain a constant temperature, but very seldom is the humidity given consideration. It is not uncommon to find air in buildings very much dryer than normal pure air, and an explanation is not difficult. Since air saturated at zero degrees will contain about one-half grain of moisture per cubic foot, and at 70 degrees one cubic foot will contain eight grains, it is clear that if air is heated from zero to 70 degrees, the humidity at the higher temperature will be only 6 per cent., and the air will then be dryer than the atmosphere of the Sahara Desert. This extreme dryness is very harmful to the mucous membrane of the human body, and is in a large measure responsible for the prevalence of disease of the nose and throat in cold climates. It is also a noticeable fact that a high temperature is required if persons are to be comfortable with a low humidity. It is well known that a thermometer with moistened bulb will register a lower temperature than a dry bulb thermometer beside it, but it is not generally known that the sensation of heat and cold experienced by people varies rather with the registration of the wet bulb thermometer than with that of the dry bulb.

DRY AND WET BULB THERMOMETERS

It is a common error to assume that the dry bulb thermometer gives a true indication of the temperature felt by human beings, and to consider all contradictory evidence as due to the mutability of human nature. Roughly, it will be found that with 55 per cent. relative humidity a temperature of 64 degrees will be as comfortable as a temperature of over 70 degrees with a relative humidity of 30 per cent.

From an engineering standpoint, therefore, we come to the same conclusion as a physician, who, discussing this subject, states that: "So long as we continue to neglect the indoor relative humidity we shall continue to live in unhygienic surroundings, created by any method of heating that is not supplied with means for properly moistening the air. To do this should be as much the purpose of a scientificaliy constructed heating system as to furnish sufficient heat.†

Any system of ventilation will necessarily add not only to the first cost of a heating equipment but also to the operating expense. Heat is considered essential because the lack of it at once affects our comfort; while breathing impure air, when one becomes accustomed to it, produces no immediate discomfort.

Through ignorance of the fundamental principles much money has been wasted in the past on inefficient or defective methods of ventilation. It is, however, considered poor practice to-day to design a heating system without at the same time making provision for a positive supply of fresh air free from dust or soot, and furnished to the building without drafts in any room.

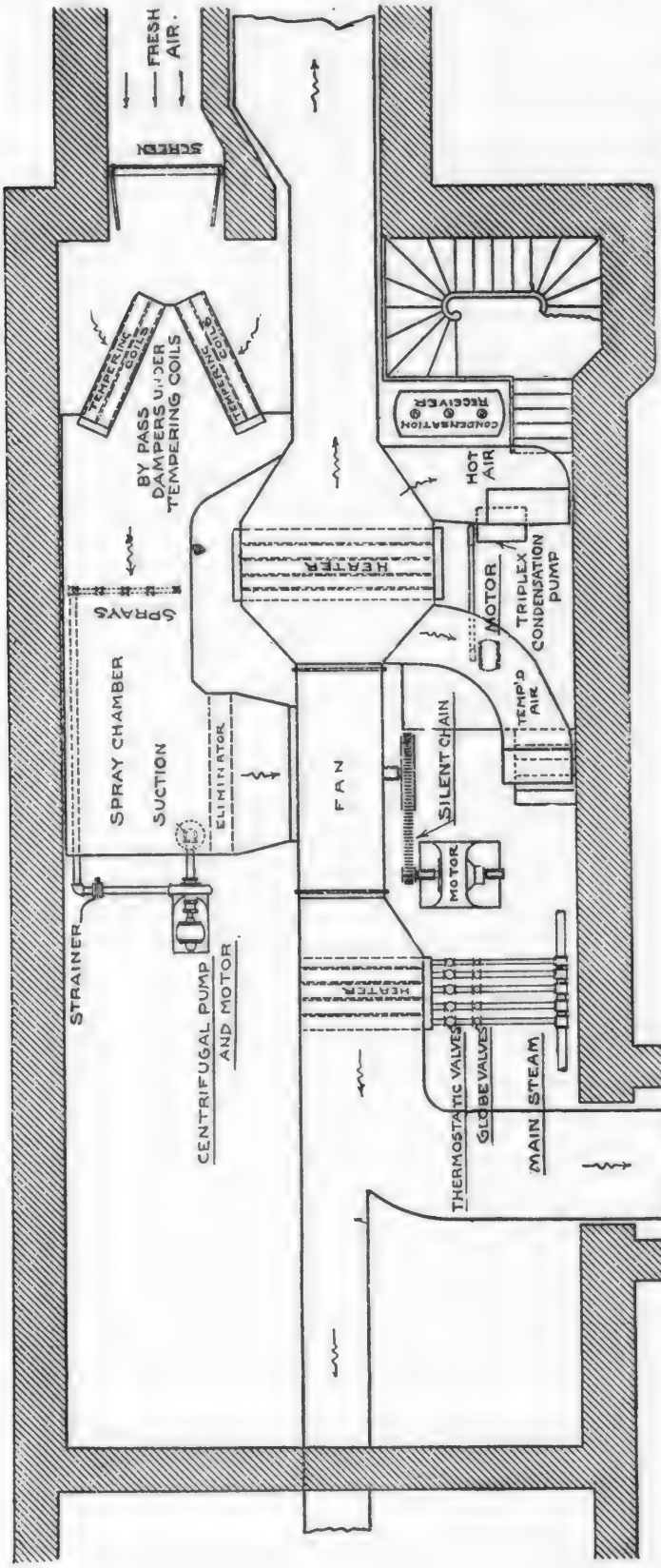
In the State of Massachusetts a law has been in force for several years making it compulsory to supply 30 cubic feet of fresh air per head per minute in all schools and public buildings.

ESTIMATED AMOUNT OF AIR FOR BUILDINGS OF DIFFERENT CLASSES

The amount of air usually estimated for buildings of different classes is as follows:

*Read before the Mechanical Section of the Canadian Society of Civil Engineers, January 18, 1906.

†Henry Mitchel Smith, M.D., in a paper before Brooklyn Medical Society, May 15, 1905.



PLAN OF HEATING APPARATUS IN ST. PAUL'S HOSPITAL, MONTREAL, QUE., TOGETHER WITH AIR WASHER AND HUMIDIFIER

	Cubic Feet per Minute per Person
Hospitals (ordinary)	35 to 40
Hospitals (epidemic)	80
Workshops	25
Prisons	30
Theaters	20 to 30
Meeting halls	20
Schools (per child)	30
Schools (per adult)	40

Fresh air contains about 4 parts carbon dioxide in 10,000, and the presence of 6 to 8 parts in 10,000 is scarcely noticeable, but the presence of 11 parts in 10,000 is distinctly perceptible, and when higher percentages are found the air is sufficiently stale to be not only uncomfortable but actually injurious. Since an adult breathes about 500 cubic inches of air per minute, and as respired air contains about 3.4 per cent. carbon dioxide, it is clear that approximately 17 cubic inches of carbon dioxide are exhaled per minute, and from these data the following table has been prepared:

AMOUNT OF CARBON DIOXIDE EXHALED PER MINUTE UNDER VARYING CONDITIONS

Parts carbon dioxide in 10,000.	Cu. ft. of fresh air per minute per person.	Percentage respired air.
4	Infinite	0
5	100	.29
5	100	.29
6	50	.58
7	33.3	.87
8	25	1.45
9	20	1.74
10	16.7	2.03
11	14.3	2.32

Common standards of good ventilation are taken as allowing between 6 and 8 parts of carbon dioxide to 10,000 parts of air, and a comparison of the two tables will show that they give about the same results. Allowance should be made for the size of the room and the period during which it is used at a time, for where there is a large space per capita, even if no fresh air is admitted, it will take some time for the air to become polluted.

MISTAKE TO USE HIGH PRESSURE IN SMALL DUCTS

With a system of forced ventilation there is a tendency to install small ducts, as the available space for ducts is generally limited, and by an increase of pressure the requisite amount of air may be delivered even with small ducts. It is a great mistake, however, to use a high pressure, even though it be available, for at too high a velocity through the ducts a rush of air is distinctly audible, and air entering and leaving rooms at a high velocity will be certain to produce uncomfortable drafts. Some device for cleaning the air supplied is also necessary, for, no matter where the inlet is placed, there is bound to be mixed with the entering air some dust and soot.

We should then aim to keep a constant temperature at a constant humidity and to supply pure screened air in positive quantities without creating perceptible drafts.

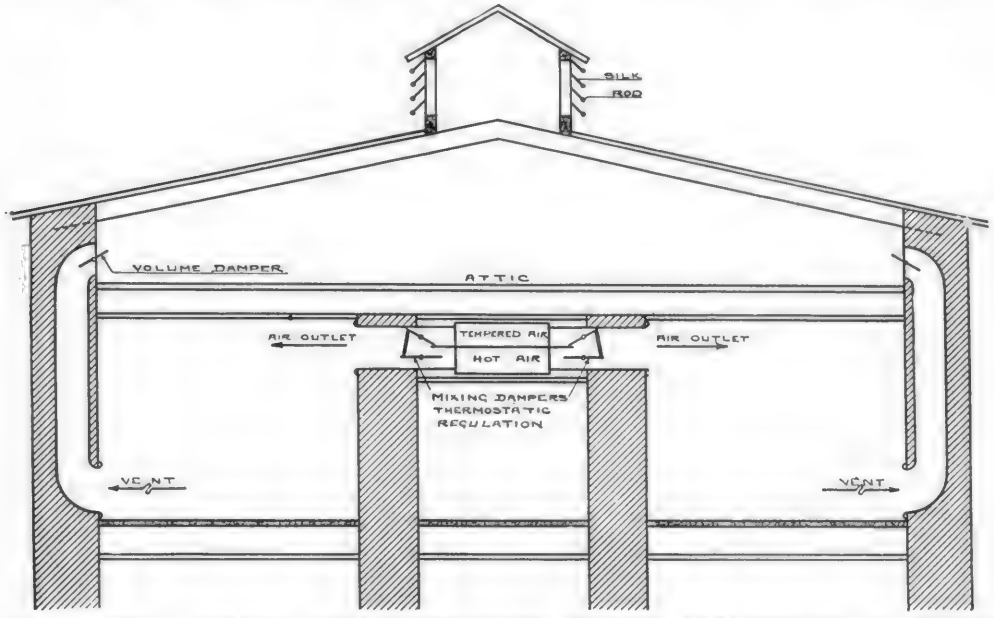


FIG. 1. TYPICAL VIEW OF DISTRIBUTING DUCTS, SHOWING ARRANGEMENT OF MIXING DAMPERS

EQUIPMENT OF ST. PAUL'S HOSPITAL

The equipment at St. Paul's Hospital consists of a motor-driven fan; tempering coils and heating coils, with their

supply and return pipes; ducts for a distribution of air, with deflectors for adjustment and dampers for control; thermostats for control of temperatures, and a combined air washer and humidifier for cleaning and moistening the air. The fan is a three-quarter housing steel plate centrifugal, with double discharge. It is driven by a direct-current motor by means of a chain drive. At full speed it delivers 45,000 cubic feet of air per minute, and by means of a rheostat in the field circuit of the motor two lower running speeds may be used. The coils are of the miter type, which are usually employed for hot water, as the resistance to circulation is very low, and in this case they are used with low pressure steam for the same reason. Tempering coils are placed between the inlet and sprays to bring the air at least above freezing point.

A temperature of 50 to 55 degrees is found necessary in the spray chamber, because the temperature in this chamber affects the humidity, and because some air by-passes the heating stack on the discharge side of the fan, and therefore goes to the rooms without a further increase of temperature.

The distributing ducts beginning beyond each heating stack carry separately hot air which passes through the heating coils and tempered air which goes above them. These ducts are kept separate until the mixing damper is reached, of which a detail is shown in Fig. 1. In each duct there is a balanced damper, and the two are joined together by a link, so that when one is open the other is shut, and vice versa.

Thus a constant volume of air is supplied at a temperature varying in such a way as to balance the heat losses from the building. In most rooms the dampers are controlled by thermostats, to give a constant temperature, but in some they are arranged for hand regulation.

AIR WASHER AND HUMIDIFIER

The air washer and humidifier is shown in detail in Fig. 2. It consists of a number of spray nozzles in a plane at right angles to the course of the air, and a box of baffle plates which remove the dust and water carried mechanically. The sprays are shown clearly in the drawing and require no further description, but there are several novel features in the "dry box" which need explanation.

In the fanroom of the hospital space is very valuable, for every foot is below the ground level, and excavation is expensive. If the cross section of the dry box is to be reduced, we must figure on a higher velocity of air in order to handle the same quantity. In this case a velocity of about 350 feet per minute is used, and the loss in friction is so small as to be almost negligible.

Considering that each plate is but 2 inches long, and the total thickness of the box but 12 inches, it seems impossible that the moisture can be completely removed. A piece of dry paper placed behind the box at any point will show no trace of drops of water, however, nor is there any perceptible moisture on the last bend of the plates. The first bends are purposely left without projection to allow a film of water to form, and it is this film which collects most of the moisture and all dust or soot. The first projection prevents most of this film from being carried through, and the remaining projections remove thoroughly whatever water may remain. While we may depend upon the film to remove all water carried mechanically, the moisture carried by absorption is, on the contrary, increased to an amount dependent chiefly on the velocity of air through the plates. At any given running speed of the fan this velocity is constant, and the relative humidity of air leaving the baffle plates at full speed remains nearly constant at 80 per cent., independent of the relative humidity of the entering air. If the temperature of the spray chamber is kept at 55 degrees, each cubic foot will carry 80 per cent. of 4.85 grains or 3.88 grains of water, which will give a constant humidity of a little more than 55 per cent. when the air is warmed to 65 degrees.

The temperature in the spray chamber is kept constant by a thermostat, which operates a by-pass damper below the tempering coils, admitting enough cold air to reduce the temperature as required. The air in the tempered air ducts will remain at 80 per cent. humidity, and the air in the hot air ducts will enter the room at a low relative humidity, but in either duct 3.88 grains are carried by each cubic foot of air, which corresponds at 65 degrees to a humidity of 55 per cent., and if the rooms are kept at this temperature the humidity will be practically constant.

Both hot and tempered air ducts are made of galvanized iron of the following gauges:

All pipes of less than 5 feet circumference, of No. 26 gauge; 5 to 8 feet circumference, of No. 24 gauge; 8 to 10½ feet circumference, of No. 22 gauge; 10½ to 13¼ feet circumference, of No. 20 gauge; 13¼ to 19 feet circumference, of No. 18 gauge; above 19 feet circumference, of No. 16 gauge.

The cross section at any point of the air ducts is designed to give a constant friction per foot of length, and each branch is designed to receive its proportionate supply, though the amount of air it receives will depend largely upon the angle at which it leaves the main duct, and at this point a deflector is installed to permit careful adjustment when taking an anemometer test.

FOUR SEPARATE BUILDINGS HEATED

There are four separate buildings to be heated, and the ducts run through tunnels to three of them. Hot and tempered air are carried in separate ducts from the coils and by-pass until close to the opening into each room, where mixing

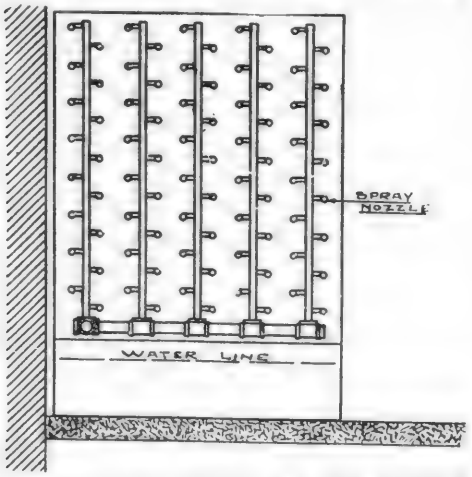


FIG. 2. AIR WASHER AND HUMIDIFIER, SHOWING SPRAY PIPES AND SETTLING TANK

dampers are located as shown in the plate.

As soon as possible after passing the dampers a gradual increase of 50 per cent. in the area of the duct is made, which makes the velocity of air entering so low that there is no perceptible draft. No register faces are used, but the iron of the duct is flanged back against the wall and covered with a plain wood border. This arrangement gives a neat appearance, and by doing away with registers gives ready access for cleaning, and an unobstructed flow of air.

The vent flues all have dampers, which are in most cases kept partly closed to ensure a slight plenum in the rooms. All vent flues lead to the attic, in which there are two ventilating towers with movable louvres. The louvres are made of a waterproof silk, with a rod at top and bottom to keep its shape. The top rod is stationary in a frame, and the bottom rod is light enough to allow air to escape but heavy enough to fall back in place if there is a tendency for air to enter.

FEATURES OF THE VENTILATING SYSTEM

It is noticeable that in such a ventilating system there are many adjustments to be made, but most of these are made when testing, and are then left permanently in a fixed position. After all deflectors and dampers are set no change can be made in the amount of air supplied, except by varying the speed of the fan, and this can only be done from the switchboard.

Thermostatic dampers in most rooms keep the temperature variation within one degree. Another set of thermostats placed in the fresh air inlet are adjusted to close off one coil of the heating stacks at 10 degrees above zero, a second at 20 degrees, and a third at 30 degrees. Similarly, one section of the tempering coils closes when the outdoor temperature is 35 degrees, and the other closes at 60 degrees. The temperature regulation is thus taken care of, and since, as already explained, the humidity is controlled automatically, the only attendance that is required is the occasional cleaning and oiling of motor, fan and pumps.

The operating expense and first cost of such a system of heating and ventilation will be higher than for a system of direct steam piping designed for heating alone. While accurate data for comparison are not available, an examination of the formulæ will show the reason for the difference found in practice.

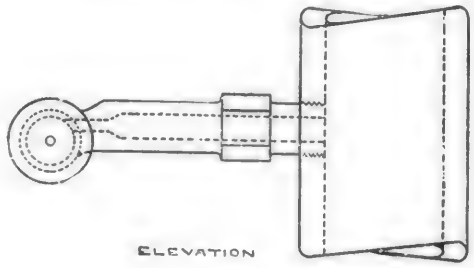
CALCULATING THE HEAT LOSSES

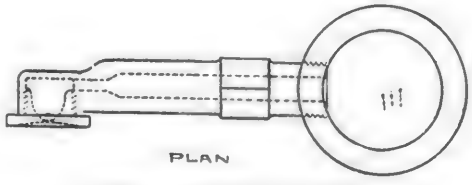
A common formula for the loss of heat from a building is

$$H = \left(\frac{n\,c}{55} + K\,G + K^1\,W \right) t$$

where

H = Loss of heat in B. T. U. per hour.
n = Number of times air is changed per hour.
c = Cubical contents of building in cubic feet.





DETAIL OF SPRAY NOZZLE

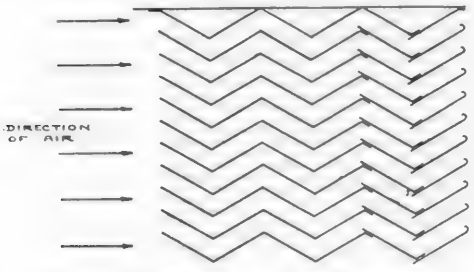
G = Area of exposed glass surface in square feet.
W = Area of exposed wall surface in square feet.
t = Difference of temperature between air inside and air out of doors.
K and K^1 = Coefficients for the loss of heat in B. T. U. per square foot per hour through glass and wall, respectively.

An average value of K is 1, and of K^1

¼, so that a general formula would be*

$$H = \left(\frac{n\,c}{55} + G + \tfrac{1}{4}\,W\right) t.$$

In this formula (G + ¼ W) t expresses the heat lost by radiation through walls and windows. This loss would be the same for either a direct steam system or an indirect heating system if the temperature in the room were uniform. To heat a building satisfactorily with direct steam it is necessary to place much of the radiating surface along outside walls. As the air back of and above these coils or radiators will be hotter than air in the body of the room, the loss by conduction is proportionately increased. Obviously, with an indirect system there is a saving, as the hot air



DETAIL OF ELIMINATOR PLATES

pipes are carried on inside walls and the temperature is practically uniform.

The expression $\frac{n\,c}{55}\,t$ is an allowance for the heat required to warm air which enters around doors and windows and through the walls. In a building 50 feet high, with an indoor temperature of 70 degrees in zero weather, there would be a pressure inward against the wall at the ground level of about one-half pound per square foot. Through openings at top and bottom air, with a free passage, would flow at a velocity of over 3,000 feet per minute. The friction of the course that such a current of air takes in an ordinary building reduces the above figures, but in any room, if the upper sash of a window is lowered, and the lower sash raised, air will flow in at the bottom and out at the top at a comparatively high velocity. When the sashes are shut, air still comes in through crevices and through the walls, and, unless the construction is exceptionally tight, unpleasant cold drafts will be formed.

The volume of air which thus passes through the building by filtration must be heated to the temperature maintained. An estimate of the volume which is to be heated must be made, and with proper allowance for the nature of the construction the value of n (the number of air changes per hour) is, for corridors, 3; for churches and assembly rooms, 2 to 2½; for ground floor rooms, 2 to 3; and for second floor rooms, 1½ to 2.

With an indirect system of heating the expression $\frac{n\,c}{55}\,t$ gives the B. T. U. required for ventilation alone. With a direct steam heating system the infiltration of air might be considered as ventilation, but the amount is uncertain and inadequate, and any advantage of ventilation received is more than offset by the injurious effect of the drafts formed. With an indirect system all entering air is heated before it goes to the rooms, and there is no leakage around doors and windows, for a plenum is formed by the fan, which reverses the natural tendency and causes an outward flow of air.

If the fan were to take its supply of air back from the rooms, no plenum would be formed, and there would be an infiltration of air as with direct steam heating. If part air is taken from out of doors and part returned, there is a proportion at which, if a window is opened on a still day, no perceptible flow of air will take place in either direction.

This is the condition when the same amount of air is taken from out of doors as would otherwise enter by infiltration. When so operated, although ventilation to the extent of about two air changes per hour is supplied, the cost of operation will be a minimum, and will be the same as for direct steam heating.

A supply of two air changes per hour is not sufficient for a hospital, and the fan takes its entire supply of air from out of doors, giving an air change in from 6 to 8 minutes, or 8 to 10 air changes per hour.

The cost of fuel for ventilation alone may be easily estimated. Assuming an average temperature of 30 degrees from December 1 to March 1, the coal required to supply 3,000 feet of air per capita per hour can be calculated from the formula $H = \frac{n\,c}{55}\,t$, which becomes

$$H = \frac{3{,}000}{55} + 30 = 1{,}636 \text{ B. T. U. per hour.}$$

In a hospital ventilation is supplied day and night, giving a total requirement of 3,533,760 B. T. U. per capita for three months.

In schools the plant would be in operation only eight hours per day, requiring but one-third this amount. Assuming an evaporation of nine pounds of steam per pound of coal, the coal required during the three months stated would be about 450 pounds per capita for hospitals, and 150 pounds per capita for schools.

*Prof. R. C. Carpenter, "Heating and Ventilating Buildings," Chap. III.

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Foreign countries, - - - - 1.50 " "

SINCE the conference of the Master Fitters' Standardization Committee with the manufacturers of pipe, valves and fittings, which was held in New York last October, little has been published of the committee's further efforts, but we understand the work the committee has mapped out for itself is progressing as rapidly as could be expected. Among other things, the committee has paid a visit to the pipe mills of the National Tube Company, near Pittsburg, and has had there the opportunity of inspecting the various processes through which pipe passes in the making.

As we noted at the time of the conference, one of the main points for which the committee is working is to find some means whereby each piece of pipe that comes from the mill shall have stamped or rolled on it, at least once in each foot of length, some mark to designate whence it came and whether it is iron or steel. This is not so simple a matter as might appear upon first thought, owing to the fact that no means has yet been found to make a pipe mould with an indentation or protrusion in it that can be used without becoming filled or clogged with cinders. One of the pipe mills is now engaged, at the instance of the Standardization Committee, in a number of tests to ascertain if such a mould can be made. The committee has also made arrangements to secure schedules of sizes for fittings, as now used by the various manufacturers, and it is proposed to compile from these schedules a list of sizes that may be called standard.

IN HIS recent paper before the English heating engineers on heat losses from buildings and radiators and calorimetric methods of determining these losses, published in our February issue, Mr. A. H. Barker concluded with an addenda, suggesting methods whereby similar tests could be made for ventilation. As an illustration he took the case of a large hall to be occupied by 1,000 persons, without an increase in CO_2 beyond 8 parts in 10,000. The ordinary method of calculation would give the amount of air that should theoretically be supplied. Mr. Barker assumed that the apparatus had been installed and it was required to test its efficiency before the hall was in actual use, so that any necessary alterations could be readily made.

On the basis that every adult exhales about 0.7 cubic feet of CO_2 per hour, and that there are 8 cubic feet of CO_2 in one pound of gas, eleven adults exhale approximately one pound of CO_2 in one hour and 1,000 adults altogether exhale 90 pounds of CO_2 per hour.

Mr. Barker's proposal is to procure about 180 pounds of liquid CO_2 and arrange to release it at a regular rate in the hall and distribute it all over the whole area

while the apparatus is working. Any of the standard methods of analysis of the air, as he states, would then determine the amount of CO_2, and if this were found in excess, at the end of a two hours' run, it would be clear that the requirements were not fulfilled, and a little circulation would show to what extent it would be necessary to increase the ventilation to secure the desired results. The point made in a test of this character is that working conditions are reproduced and the important variable of which it is required to ascertain the variable can be not only varied at will, but measured while the apparatus is actually doing the work it will be called upon to do.

A PLANT that is designed, not merely as an induced draft, but as a means of doing away with cinders emitted from smokestacks, is a novelty, and the fact that such a plant has lately been constructed and is in successful operation, will lend added interest to the description of it, which will be found on another page of this issue. It is described by its designers as the only one of its kind in the world. The necessity of a cinder separating device, in this particular case, was due to the fact that the power house was located close to a lumber yard, and cinders were constantly ruining large quantities of lumber. While only preliminary evaporaton tests have been made, it is interesting to know that these tests show conclusively that the increase in capacity will more than pay the entire cost of the work, as against the installing of additional boilers, although the main purpose of the plant was the separation of cinders.

THE MILD weather of the past winter, especially in the East, has caused a strong fire to be directed at mechanical ventilation, especially on the part of those whose knowledge of ventilation is confined strictly to that obtained by the opening of windows. Much of the fault undoubtedly rests with the operating engineer who has continued to furnish tempered air on days when the outside temperature was so high as to make any artificial heat unnecessary. Moreover, in many buildings thermostatically controlled, the thermostats have been unable to cope with the situation, so that in spite of these automatic devices, the inside temperature has risen to a point where the only relief lay in opening the windows. Such a situation has arisen in some of the New York City public schools, and coming, as it has, on top of a circular letter sent to principals regarding the opening of windows when forced ventilation was in use, raised an outcry which called attention to the real defects that can be found, during mild weather, in mechanical ventilation, as usually installed. We described some months ago a method of controlling the temperature in mechanically ventilated buildings that should be a close approach to a remedy for the overheating of buildings. According to this method, there are thermostats both in the tempering coils, reheater coils and in the by-passes to control the temperature of the air delivered to the system. By this means it is possible, on a mild day, with the system in full operation, to have air admitted from the outside, pass through the apparatus and be introduced into the rooms with little rise in temperature.

Requirements of Small Refrigerating Plants of Less Than One Ton Capacity *

By Martin R. Carpenter

In discussing this subject, we will have to consider the matter in a general way only and from several viewpoints; the main ones are that of the purchaser (or user), and then the manufacturer (or seller).

SOURCE OF DEMAND FOR SMALL MACHINES

Taking that of the purchaser first, we will find the demand for small machines, of about one-ton capacity, will come from small butchers in cities, who desire the advantage accruing from dry, cold storage, and also, from those so located that ice is not obtainable, or the supply is uncertain. The economy of such plants, compared with use of ice, ignoring the advantages to be gained by having the storage-rooms dry, depends largely upon the cost of ice and cost of power. If the purchaser has power available and does not have to run an engine or motor expressly for operating the machine, the economy will be upon the side of the machine; otherwise, when considering the amount of the original investment, depreciation, cost of operating, care and attention, and, lastly, repairs—ice (under conditions usually existing in cities) will be found the cheapest.

In the above comparison, we are considering temperature of from 38 to 40 degrees. If temperatures of 32 degrees or lower are required, the use of a machine is almost a necessity.

There is another point to bear in mind when considering the sale of machines for use in small markets, and that is the fact that, as a usual thing, such a marketman's total investment in fixtures, etc., is only from $400.00 to $600.00, and an outlay of from $600.00 to $1,000.00 for a refrigerating machine is out of the question. It is evident from this that the sale of small machines in such places will be very limited.

Another source of demand is that from hospitals, restaurants, cafés and saloons, and machines of one-ton or less may or may not prove advantageous, depending largely upon the nature of the work to be done, though, on the whole, providing power is not too expensive and extra expense is not entailed in order to secure some attention to the machine, it will, as a usual thing, prove a good investment, both in the economy over ice for maintaining refrigerated boxes, but more so as a result of having the boxes colder, drier, more sanitary and preventing the slop and dirt attendant upon the use of ice.

Another case which we should take into consideration, is that where a temperature of 30 degrees or less is required, in that case the machine has many advantages; and the demand for this class of work will come from furriers, fish markets, and sometimes from cafés and restaurants, and while the demand is not very extensive at the present time, it is gradually growing.

We have been considering the demand for machines of about one-ton capacity, in places where they had to compete with ice; we will now consider it from points where ice is not obtainable, or if it can be secured, the cost prohibits its use to any great extent.

There are a great many towns of small size so situated that it is almost impossible to ship ice to them; and, as they are too small to support an ice factory, ice is almost unknown. These towns may have from one to three meat markets; and the method usually followed during hot weather, is to kill early in the morning and dispose of the meat within 48 hours at the most. This means a limited stock of very tough and unseasoned meat most of the time, and at other times meat that is too well seasoned to be palatable. In such cases the cost of operating a small machine is of secondary importance, when the results are considered.

Another point of demand comes from contractors' camps; but this is not of much consequence, because, as a rule, such camps are maintained for a short time only and it would hardly pay to install a machine for temporary use. So much for machinery of about one-ton capacity.

We will now consider the demand for smaller machines, down to those of 200 lbs. capacity. The demand for these will come from stores and residences in cities, largely as a novelty, and also from country clubs and private residences, so situated that ice is difficult to obtain but where electric power is available. The use of any other power than electric motors will necessitate too much care and attention; though small gasoline engines can be used, providing some one attends to them with more knowledge of machinery than that possessed by the average servant employed in such situations.

As we have considered in a general way the possible and probable demands for these machines, we will now consider the types and designs of machines, and outfits necessary to furnish, in order to meet the requirements of such cases and to make them practical.

TYPES AND DESIGNS OF MACHINES

In the first place, it is necessary—with some few exceptions—to install as complete an outfit as is required in machines

*Paper read at the first annual meeting of the American Society of Refrigerating Engineers, in New York, December 5, 1905.

of larger type. They must have all the necessary parts, such as motive power, compressor, condenser, expansion piping, with their necessary valves, etc., and must be so designed and installed that they will require almost no attention, except starting and stopping. This applies, in a great measure, to machines of about one-ton capacity, and becomes more imperative as the size of the machine decreases. Also the fact that the greater number of these machines are required, because the location is isolated, makes it all the more necessary to have them reliable, for experts in this line are difficult to obtain in such localities, without considerable expense and delay. It is necessary also to have them automatic in their control as far as possible; and, again, this addition of working parts renders them just so much more complicated and liable to go wrong, and adds to the difficulty of repairing when anything is out of adjustment.

ATTEMPTS TO PRODUCE AUTOMATIC CONTROL

One of the first points to receive attention in the attempt to produce an automatic control, was that of the regulating or expansion valve; and one of the earliest attempts was made by a representative concern who experimented with a device for measuring the liquid. This arrangement consisted of two disks, the lower one stationary, and the top one revolving. The lower disk had a port which was connected to the liquid line, and allowed the liquid to feed into a cup or recess in the upper disk. This upper disk revolved at a certain speed, proportioned to the speed of the compressor. The liquid in the cup—or receiver—of the upper disk was carried on around and emptied through another port leading to expansion coils, and the amount of liquid which was supposed to go through was calculated to be within the capacity of the compressor to care for. While this was a very ingenious arrangement, not much more can be said of it. Various other attempts to regulate the flow of the liquid have been made in connection with the expansion valve, principally by means of a diaphragm arrangement, working the valve spindle by the variation of the back pressure. This works satisfactorily, except when the very minute opening through the valve becomes clogged up with some foreign substance, and again the expansion coils are apt to become flooded when the valve first opens, especially if the coils are very cold. This then allows the liquid, or if not actual liquid, then very heavily saturated gas, to go into the compressor, which often results in trouble of some kind or other, varying with the different styles of machines.

AUTOMATIC CONTROL OF EXPANSION VALVE

As far as machines of about one-ton are concerned, the automatic control of the expansion valve is all that is demanded to relieve the machine of hourly attention; but in small machines—especially those for household use—each working part must be able to care for itself automatically, as in such places these machines will have to be under the care of persons who are, as a usual thing, totally ignorant of mechanical devices, and the turning of a switch must start and stop the machine.

I am supposing in the above case that the plant is so equipped that it is necessary to run working hours only, and that some attention will be given to see that the condenser water is running and various other points which need attention will receive it, such as oil on the bearings, that the condition of the stuffing box is such that it is not leaking, and that there is sufficient ammonia in the system. I have never heard of any automatic devices to care for such parts and conditions.

There is one machine on the market controlled in almost all its moving parts by automatic devices, worked by electric current, and operating through a multiplicity of switches, magnets and rheostats. This equipment is so installed that the machine is started and stopped as the temperature of the refrigerator varies.

It also has an additional device to stop the compressor, should the water supply on the condenser fail. This machine is supposed to run night and day, starting and stopping itself, as the temperature varies, and needs no attention whatever, except to see that there is ammonia in the system and oil on the bearings.

What effect it would have on the ability of the machine to continue its work should anything happen to one of those delicately adjusted devices and just how much of an expert would be required to remedy the difficulty, I am unable to say. However, perfection along these lines is almost absolutely essential to the success of the small machines, and whoever succeeds in devising such controlling devices so they are practical and reliable when in the hands of a novice will surely reap a reward, perhaps in riches; it may be fame; if neither, here, he may find his ability and knowledge to stand him in good stead in the hereafter, where some of the victims of his earlier attempts may have consigned him.

CONDITIONS FOR SECURING PROFIT

The financial reward will be governed by the ability to install and operate these machines at a cost not out of proportion to the results gained.

Machines of from 1,500 lbs. to one-ton capacity will be installed on the premises by an erecting engineer; those of smaller sizes, from 500 lbs. down, can be shipped out complete, refrigerator and machinery contained on one base, charged with the

medium and ready to start as soon as water and power are connected.

While the larger machine would, as a usual thing, be recharged from a shipping drum, the smaller ones may be arranged so the receiver can be disconnected and a new one—ready filled—connected up in its place, without the necessity of pumping down or blowing out.

ONE METHOD OF INSTALLING SMALL MACHINES

One method of installing small machines, is to place the expansion coils in a tank of brine, making no effort to automatically start or stop the machine as the temperature of the refrigerator varies, but allowing it to run a number of hours each day, as is necessary to produce the results; thus removing enough heat from the brine to enable a practically uniform temperature to be maintained in the refrigerator. The water supply should be so arranged that the act of turning on or off the power would, at the same time, regulate the water valve. And if, for any reason, the water failed, the power should be automatically cut off and the machine stopped. No matter how automatic and fool proof, there will come a time when the services of some one with a knowledge of the machine will be required, and this necessity will have to be taken into consideration by a manufacturer who makes an atempt to market his products to any considerable extent.

INTEREST OF ELECTRIC COMPANIES

As electric power is the simplest and easiest to use in connection with these small units, the power companies are showing considerable interest in the development of this type of machinery, and are ready to take up and push the sale of them on their own account, when convinced of their reliability, in order to secure the sale of their surplus power; and no doubt it will pay them to keep in their employ some one to look after these machines in a general way, providing there is a sufficient number of them being used in their district. Several large companies have considered the advisability of leasing and operating these machines at an annual rental, thus relieving the householder of all responsibility or investment.

COST OF OPERATING SMALL MACHINES

As regards the cost of operating these small machines, I cannot speak with much authority, as I have not had the opportunity of making any reliable tests; the only one that I ever observed cost, for electric power, about the same as the cost of ice for the same size box, and gave practically the same temperature.

DIFFICULTIES OF INSTALLATION

So far I have said nothing regarding the difficulty of installing these machines, to accomplish the work specified. This, of course, is easy in the household refrigerator of about 500 lbs. or less, as both the refrigerator and the machine are built in the factory and duplicated in size and design. But when the one-ton and down to 1,500 lb. machines are to be installed, some pretty careful calculations have to be made, and a good deal of judgment displayed; for, as a usual thing, purchasers want the maximum size of room cooled and don't care to invest much in insulation. This means a very small margin of capacity.

Again, these machines are apt to be connected up to a box built for ice, and here we have another difficulty to overcome, due to the fact that the arrangements for the circulation of air when using ice will not be effective when using a machine.

There are outfits now on the market, of a size suitable for household use, using 200 and 300 lb. compressors, equipped with automatic controlling devices, as has been mentioned, and made to be driven by belt power, from motor or gas machine, which can be bought, exclusive of power, for $300.00 or $400.00.

Just how soon these machines will come into common use, will depend somewhat upon how soon the accomplishments of the cook will include a knowledge of how "to pack the stuffing-box," etc.

CORRESPONDENCE

Mechanical Ventilation, Dust and the Opening of Windows

Editor HEATING AND VENTILATING MAGAZINE:

It is not often that one finds in a responsible journal so short a statement, containing so many obviously wrong impressions as the following, which appeared in *The American Architect* of January 27 last, and reprinted in *Municipal Journal and Engineering* of February 7:

"Recently the New York Board of Education issued an order to the effect that the school teachers should no longer undertake to ventilate their classrooms by opening windows when conditions seemed to require it, the reason for the order being that the schools were now ventilated by some mechanical apparatus, and, moreover, the opening of the windows was wasteful of heat and caused an increase in the coal bills!

"Naturally the teachers, who know what the conditions actually are, protest vigorously, and if the facts are as stated the ventilating device, whatever it is, is certainly not properly installed.

"In one case the inlet shaft, which has its opening only four feet above the pavement! is placed in a re-entrant angle of

a court where, the school being near a market house, dust and orange wrappers are seen constantly eddying about as high as the fourth-story windows. Here, though the rooms are dusted twice a day, one can at twelve o'clock write one's name in the dust upon a desk that was dusted at ten.

"In this building is the Training School for Teachers, and the record of deaths from quick consumption among these well-grown pupils is said to be startling. The engineer in charge of the apparatus says that 'the quantity of dust is so enormous it would clog cotton filters in an hour and stop the fans, and one man would have to spend his whole time changing them.' Probably a man's time could not be better employed—that is, if the inlet must be just where it is and only four feet from the pavement."

From the wording of the article it is quite evident that no attempt was made to verify the statements made, and the result is that a very ridiculous as well as false impression is given which casts discredit on the city and causes parents to be afraid to send their children to school.

The article is, without doubt, based upon the letter sent to *The New York Times* by a graduate of said training school, who was so anxious to create a sensation that she omitted part of the truth.

The facts of the case, which can easily be verified by a visit to the building (Public School 159, 119th street, near Third avenue, Manhattan), are as follows:

THE FACTS IN THE CASE

The building has been occupied for several years by a teachers' training school and a primary school in connection therewith. Out of the thousands of young ladies trained in said building the principal only knows of ten deaths since the school opened. Of these ten, two died during the summer vacation—one from accident (having fallen to death) and one from fever. Of the other eight, five were in the class of the aforementioned author, and as they are reported by her to have died from consumption all in one year, it is reasonable to suppose that they got their consumption from contagion, and, from the absence of any other reported consumption deaths among the students of other years, it is almost unquestionable that the sanitary conditions in said school are so good that not only did said students not get their disease in said school but that others were prevented from contracting the disease from the sick ones.

DUST THROUGH OPEN WINDOWS

As to dust: If volumes of dust really soared to the fourth-story windows as reported, how would permission to open the windows better the conditions? Would not the dust enter the windows easier than to get through the small air spaces between the parts of heating stacks, through blower, ducts and wire screens?

The writer visited this building on the Monday morning after the letters appeared in *The Times*, and found a handful of newspapers lying in the courts, but no papers or other refuse on the screens before the three fresh-air intakes.

Dust, like the poor, we have with us always, whether on street or indoors, else why should the good housewife need a broom and duster? But there is no visible dust entering the classrooms in said building, and the dust on the desks is mostly dust from the scuffling of feet of the forty to fifty pupils in each room and from the crayon used on blackboards.

It is an actual fact that the open windows permit the entrance of much more dust than is brought in by the warmed fresh air delivered in quantity equal to thirty cubic feet per minute to each pupil, by means of steel plate blowers located in cellar. The air is taken in from four to eight feet above the pavement of the courts at a distance of at least sixty feet from street through wire screens, is heated to a temperature of from sixty-five to seventy-five degrees Fahrenheit to suit the outdoor conditions, and is delivered to the rooms through galvanized iron ducts and flues, with wire screens in the classroom openings. The vitiated air is forced out of the rooms through other flues gathering together into hoods above the roof.

TEST OF CO_2 IN OUTGOING AIR

Several tests with Dr. Wolpert's testing device showed the amount of CO_2 present in the vitiated or outgoing air of the many classrooms tried, to be about seven to eight parts in ten thousand, which is very little more than what is found in the surrounding outdoor air.

SMOKE TESTS SHOWED CHANGE OF AIR IN FIVE MINUTES

Smoke tests tried in several rooms showed that fresh air entering near the ceiling traveled across the room, dropped to level of pupils, and then swept back around pupils and into the vent outlet, and the air in occupied portions of rooms was entirely changed in from five to six minutes, as was shown by the entire clearing out of smoke from breathing space in that time after smoke tests started.

COMPARISON MADE WITH THEATER VENTILATION

The system of ventilation used is the same as in the best modern theaters, except that as the air sent into the school rooms is heated only to the room temperature instead of being heated, as is done in theaters, to double the room temperature, the school room air is not overheated and made lifeless, but whoever suggested the opening of windows in a modern, high-class theater? Such a one would be laughed to scorn.

AIR FILTERS INADVISABLE IN SCHOOL WORK

In regard to filtering the air before sending it into rooms, while such a procedure is entirely practicable and is often done where even the ordinary dust brought in through open windows is a source of trouble, as in a library or a department store, making much dusting necessary, yet the very considerable expense entailed in the filtering of air is so serious a question that in a school room, where much more dust is made by the occupants than could possibly be brought in by the air, it is believed by the best engineers (and it is so stated by Professor R. C. Carpenter in his textbook on heating and ventilation) that air filtering is inadvisable except in extreme cases.

AIR INLET NEAR GROUND

As to taking air from so near the ground, it is sufficient to recall the fact that most of us, especially the school children, breathe air taken from a level lower than four feet whenever we walk or ride through our streets, and few of us filter such air before breathing it; yet it is a well-known fact that persons who are out of doors constantly are the healthiest. Can the air at breathing level be so very bad?

INTENTION OF CIRCULAR REGARDING OPENING OF WINDOWS MISUNDERSTOOD

The entire question of ventilation of our schools arose from the fact that the principals of our schools misunderstood the intention of a circular letter sent to them regarding the opening of windows when plenum (forced) ventilation was in use, and from the fact that the majority of the janitors in charge of the schools did not understand how, or did not appreciate the necessity, for regulating the heating systems so that rooms would not be overheated by the direct radiators in the rooms.

MILD WINTER AFFECTS THERMOSTATS

The janitors seem to have relied upon the automatic (thermostatic) temperature regulating devices installed in all classrooms, but not in halls, toilets, etc. Unfortunately, automatic devices are not able to meet all conditions which may arise and, owing to our very mild weather this winter, the thermostats have been unable to cope with the situation unassisted. The halls, etc., where the janitors should give personal attention, have been allowed to get up to eighty-five and ninety degrees Fahrenheit, whereas they should be kept at about sixty-five degrees. The entire amount of direct radiation in classrooms has been allowed to remain in service, where one-half the surface should have been shut off, not being needed except in really cold weather.

The heat of the bodies in rooms, the heat of the steam bottled up in radiators when the supply of steam to said radiators has been shut off automatically by the action of the thermostat, the heat of the sun beating into the windows and the heat from the overheated halls—all have acted to raise the room temperature from sixty-eight or seventy degrees Fahrenheit, at which the thermostat acted, to seventy-eight or eighty degrees Fahrenheit in many cases, and the system has been blamed, where, if it had been properly handled, everything would have been entirely satisfactory.

I do not blame the teachers for complaining under such conditions, and windows must needs be opened when temperature goes above seventy-four degrees Fahrenheit.

A second order was sent to the principals explaining that they did not go contrary to the rules governing them if they opened windows where necessary, but that such necessity should be at once reported to the superintendent of school buildings for correction.

BLOWER SYSTEM FAVORED IN SCHOOL WORK

The system used in our schools is not a patented system, but is the combination of direct radiation for heating and steel plate blowers delivering tempered air into all classrooms for ventilation only. This is conceded by all the most eminent engineers and architects to be the very best means of heating and ventilating school buildings.

In closing I may add that the chief medical inspector of the Brooklyn Board of Health visited a school similarly heated and ventilated, and after careful study of the conditions there existing, he reported in favor of the blower system, which we are installing in all new buildings of more than four classrooms.

I have also to refer to an article which appeared last November in several of the heating trade papers, dealing with heating and ventilating in this country as viewed by a prominent English engineer, wherein he states that he visited many schools and theaters in many cities during a recent tour of the United States, and that in his judgment the schools of New York city are the best ventilated and heated in this country.

FRANK G. MCCANN.

Engineer in Charge of Heating and Ventilating and Electric Work in Public Schools of New York City.

New York, March, 1906.

Ventilation Laws in Bound Form

A limited edition of the ventilation laws of Massachusetts, New York, Pennsylvania and New Jersey, bound in vest-pocket size, will be published April 1, next, by THE HEATING AND VENTILATING MAGAZINE COMPANY. Copies of this booklet may be obtained from the publishers, 1123 Broadway, New York, at 10 cents each, net, or 12 cents postpaid.

TRADE AND MISCELLANEOUS NOTES

Convention of Salesmen of the Kellogg-McCrum-Howell Company

We present herewith a group picture of those present at the recent salesmen's convention of the Kellogg-McCrum-Howell Company, which was held February 5 and 6 last at East Norwich, Conn., where one of the company's factories is located. Among those in the group are: President C. V. Kellogg, Secretary and General Sales Manager H. T. Gates, William Grier, assistant general sales manager; John Sanderson, of the order department; A. P. Bagley, manager of the Boston office; W. P. Smith, manager of the Philadelphia office; F. D. Gosman, manager of the Baltimore office; and R. B. Ammon, of Anderson & Ammon, Pittsburg.

OFFICERS AND SALESMEN OF THE KELLOGG-McCRUM-HOWELL COMPANY, IN ATTENDANCE AT THE ANNUAL CONVENTION OF THE COMPANY, AT EAST NORWICH, CONN., FEBRUARY 5-6, 1906

Trade Literature

Ventilation of Buildings, by Wm. G. Snow and Prof. Thomas Nolan, is a booklet in the Van Nostrand science series, containing, in small compass, the general principles of ventilation, and describing also the different systems of ventilation and the ventilation of various kinds of buildings. Much of the subject matter is compiled from a series of lectures by the authors in the Department of Architecture of the University of Pennsylvania. The book sells for 50 cents. Pp. 83. Size, 3¾x6 inches.

"House Hints," for those who build, buy, improve or rent, second edition, by C. E. Schermerhorn, has just been published by the House Hints Publishing Company, of Philadelphia, and is an exceedingly interesting treatise, containing the essential details pertaining to site, location, arrangements, construction, plastering, heating, plumbing, lighting, decorating and furnishing of the house. Over six pages are devoted to the subjects of heating and ventilating, the various systems being described without prejudice. Price, 50 cents. Pp. 50. Size, 6x9 inches (standard).

Kinnear Pressed Radiators and some of their advantages are described in the new folder issued by the Kinnear Pressed Radiator Co., Pittsburg, Pa., which con-

tains also an interesting illustration of the manner in which these radiators may be installed to advantage in fireplaces. The radiators are equally well adapted for steam, hot water or vacuum systems.

The Webster System and Its Imitators is a pocket folder newly issued by Warren Webster & Co., Camden, N. J., disposing of some of the arguments that are sometimes raised by imitators in this field of heating. A number of little incidents in actual experience are told to illustrate the points raised, and the imitators of the system are urged to remember the wisdom of Josh Billings, who said: "When I see a snaix's head sticking out ov a hole, I bear off to the left, and say, 'That hole belongs to that snaix.'"

Capitol Solar Boilers and their latest features are described in a new pocket circular, dated February, 1906. United States Heater Company, Detroit, Mich. Pp. 16. Size, 3¾x6 inches.

Deaths

Fred D. Johnson, president of the Fred. D. Johnson Company, 28 East Twentieth street, New York, died at Green's Farms, Conn., February 22 last, of pneumonia. Mr. Johnson was 43 years old, and has been connected with the heating trade for twenty years. At the time of his death he was engaged in the manufacture of a cast-iron sectional boiler, of his own design, for house heating.

Manufacturers' Notes

H. W. Johns-Manville Company, New York, held its annual convention for its branch managers and salesmen during the first week in February, at the home office, which was attended by 150 men. The convention closed with a dinner at the New York Athletic Club.

National Radiator Co., Johnstown, Pa., at its annual meeting, February 15, increased its capital stock from $100,000 to $350,000. A deal was closed with the

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Lorain Steel Company for the purchase of one and one-half acres of additional land, and plans were laid for extension to the radiator plant and improvements to cost between $75,000 and $100,000. The present plant covers three acres.

Warren Webster & Co., Camden, N. J., announce the removal of their New England offices from 1106 to 1108 Penn Mutual building, Boston, Mass., where more commodious quarters have been secured to handle the company's increasing business in that section.

American Radiator Company, as shown by the report of the company's officers, has enjoyed an exceptional degree of prosperity during the past year. Its net profits for 1905 were $833,917.00, an increase of $130,000.00 over its profits for 1904. This showing enabled it to pay, in addition to the preferred dividend, a percentage of over 12½ on its common stock. President Clarence M. Woolley, in his report, noted, in addition to the satisfactory earnings of the company, the steady progress that is being made in improving the quality of the products through the elimination of old methods and the introduction of special mechanical devices. President Woolley reported a steady growth of the foreign business of the firm.

Burnham-Hitchings-Pierson Co., a recent consolidation of Lord & Burnham Company, of Irvington; Hitchings & Company, of New York, and the Pierson-Sefton Company, of Jersey City, has been dissolved by mutual consent, and each firm will resume its business as conducted previous to the consolidation. One of the reasons for the termination of the partnership, it is understood, is that it was found difficult to adjust the various interests represented according to their relative importance.

Babcock & Wilcox Company, New York, and the Stirling Consolidated Boiler Company, Mansfield, Ohio, have been merged into one corporation. These firms are among the largest manufacturers of water tube boilers in the country. The new corporation will have a capitalization of $15,000,000, which is nearly double the present combined capitalization of the two companies.

American Radiator Co., Chicago, Ill., has leased the Boal lot and four-story building for a term of ninety-nine years, commencing February 1, 1906. This property is next to their present building.

Albany Steam Trap Co., Albany, N. Y., has bought the Doncaster property on North Pearl street for $10,000. The company intends to move its business here as soon as possible. When the building is completed, the company will have a plant 40x80 feet and four stories high.

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Miscellaneous

Bureau of Labor, Department of Commerce and Labor, is preparing a report covering the various systems of workingmen's insurance and employers' liability both in this country and abroad. In this connection, it desires to secure information concerning the existence in the United States of establishment funds, that is, mutual relief or insurance funds organized to be maintained by employees or relief funds maintained by the employers themselves. We have been asked by the Department to request that persons possessing data on this subject communicate with the Bureau of Labor at Washington, D. C.

France is to have an international exhibition of the textile and allied industries during the summer of 1906. The exhibition will open in Tourcoing, France, on May 1 next, and will close September 30. Among the exhibits will be the products and machinery for textile, mechanical and electrical industries; also all exhibits pertaining to social economy and hygiene. It is probable that a number of American manufacturers of heating and ventilating apparatus will have exhibits at this exposition. Further information on this subject may be obtained from the special commissioner for the American section, Henry G. Bayer, 47 Barclay street, New York.

Cleveland, Ohio.—The City Council is arranging plans for the installation of a high pressure service in the business district of this place. Pipes are to be purchased and 8, 10, 12, 16 and 20-inch mains are to be laid. The council has authorized the expenditure of $92,000 for the pipe. The estimate for the pipe, valves and hydrants is about $140,852. Bids will be advertised for soon.

United Employers' Association of Roofers and Sheet Metal Workers, Greater New York, held their first annual meeting in the Teutonia Assembly Rooms, 150 Third avenue, February 13 last. The regular ticket was elected, George Brown, Jr., being made president.

Chicago.—In correction of an item appearing in our February issue regarding the agreement between the steam fitters and employers of Chicago, it should be stated that the employers have made a three-year agreement, running from April 1, 1906, to April 1, 1909, the wages to be as follows: From April 1, 1906, to September 1, 1906, $4.50 per day; from September 1, 1906, to April 1, 1907, $4.62½ per day; from April 1, 1907, to April 1, 1909, $4.75 per day. This agreement is with the steam fitters only, and not with the gas fitters or plumbers.

Charles W. Woodward, who has been secretary of the Association of Manufacturers and Jobbers of Plumbers' Supplies and also of the National Committee of the Confederated Supply Associations, has resigned from both bodies. The vacancy has been filled by the appointment of Frank S. Hanley, who was the assistant secretary.

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Business Changes

Thomas Barwick Engineering Co., 2532 Park Row building, New York, is the title of a firm of consulting engineers recently formed by Thomas Barwick. The firm will design and supervise power plants, heating and ventilating equipments, etc. Mr. Barwick has had many years' experience in these lines, and is well known to the trade.

Herbert A. Joslin, New York, has assumed the managership of the eastern business of the National Regulator Company, of Chicago, with headquarters at 2603 Broadway, New York. Mr. Joslin was until recently connected with the New York branch of the Powers Regulator Company.

Frank B. Barrett, New York, has resigned his position as one of the New York representatives of the Pierce, Butler & Pierce Mfg. Co. to become a partner in the firm of H. M. Weed & Co., of New York, building contractors. Mr. Barrett by his genial personality has made hosts of friends in the heating trade, whose good wishes will follow him in his new field of work. He has been for several years captain of the Eastern Trade Golf Association and is the holder of the President's Cup in that organization.

H. C. White, Boston, Mass., has recently been transferred to the New York office of Jenkins Bros.

John Hankin & Bros., New York city, have removed to their new quarters at 550-552 West 25th street, which will give them additional space for their increased business.

Herendeen Manufacturing Co., Geneva, N. Y., announces the removal of its New York office from 39 Cortlandt street to 296 Pearl street, the new telephone number being 4959 Beekman.

Witlock Coil Pipe Co., Elmwood, Conn., has increased its capital from $200,000 to $500,000. The company will manufacture feed water heaters.

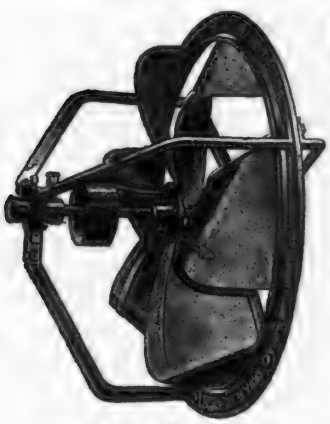
New Corporations

G. A. Suter & Co., New York city, has been incorporated with a capital of $100,000 to manufacture and install steam power, heating and ventilating apparatus. The incorporators are: George A. Suter, Frank T. Chapman, John E. Jeffery, Freeman C. Griswold and Herbert A. St. George, all of New York.

Hall & Hurlbert, Brooklyn, N. Y., have been incorporated with a capital of $50,000 to manufacture boilers, etc. The incorporators are: A. Hall, John F. Hurlbert, L. C. Valentine, Jr., all of Brooklyn.

Reynolds Heating Co., Chicago, Ill., has been incorporated with a capital of $60 000 to manufacture heating apparatus. The incorporators are: E. Burt Brown, Harrison R. Brown and Lynden Evans.

United States Heater Co., Detroit, Mich., has filed articles in St. Louis, Mo.,



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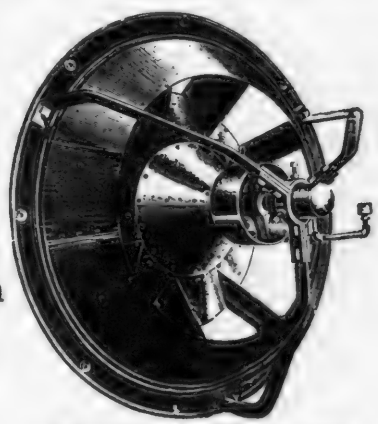

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to show that it is incorporated under the laws of Michigan with a capital of $200,000, of which $10,000 is to be employed in Missouri, with an office at Kansas City.

Toner Plumbing & Heating Co., Oshkosh, Wis., has been incorporated to carry on a general plumbing and heating business, with a capital of $10,000. The incorporators are: Owen A. Toner, Mina L. Toner and Charles Cronk.

Hart Valve Co., Camden, N. J., has been incorporated with a capital of $150,000 to manufacture valves, tools and sanitary supplies. The incorporators are: Walter and George Hart, I. B. Maitland, G. W. Flemming, Albert M. Munzinger, all of Williamsport, Pa., and Thos. P. Hall, of Camden, N. J.

United States Automatic Heat Regulator & Ventilating Co., Newburgh, N. Y., has been incorporated with a capital of $500,000, to manufacture heat regulators and ventilators. The incorporators are: F. C. Chadborn, M. T. Keogh, D. S. Gerow, R. H. Barnett and M. H. Keogh, all of Newburgh.

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Van Zandt Plumbing and Heating Co., Fort Worth, Tex., has been reorganized, with a capital of $15,000. The incorporators are: Claude Van Zandt, W. E. Thatcher and I. L. Van Zandt.

Alexander Duncan Co., New York, has been incorporated, to manufacture ventilators, hot air filters, etc., with a capital of $10,000. President, A. Duncan, East Somerville, Mass.

Phelps Bros. Co., White Plains, N. Y., has been incorporated, to manufacture heating apparatus, with a capital of $50,000. The directors are: F. S. Phelps, L. S. Phelps and J. W. Phelps, of Brooklyn.

Practical Plumbing and Heating Co., Toledo, Ohio, has been incorporated, with a capital of $15,000. The incorporators are: A. H. Lang, Fred Brice, W. C. Jones, Edgar W. Johnson and C. W. Watts.

Business Troubles

United Heating Co., steam heating contractors, 174 Wooster street, New York, has failed, with liabilities of $95,000 and assets of $50,000. The largest creditor is George Walton, president of the company, having a claim of $65,000 for money loaned.

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Contracts Awarded

Iron City Heating Co., Pittsburg, Pa., heating the addition to the Mercy Hospital.

Nord & Hird, Aurora, Ill., installing a suction fan ventilator system in the plant of the Faultless Mfg. Co. at West St. Charles.

Storms & Co., Newark, N. J., completing the steam heating in the Elliott Street School, contract price, $4,190; the Belmont Avenue School, contract price, $6,360, and the Fourteenth Avenue School, contract price, $4,490.

Walworth Mfg. Co., Boston, Mass., installing the piping in the new boiler house of the American Graphophone Company, Bridgeport, Conn.

Pelton Bros., Herkimer, N. Y., plumbing and heating the Court House.

C. H. Babb & Co., Bangor, Me., installing the steam heating apparatus in The Lowder.

E. C. Long, Hannibal, Mo., furnishing the heating in J. F. Meyer & Co.'s planing mill.

J. R. Scanlon, Elgin, Ill., plumbing and heating Frank O. Lowden's residence at Oregon.

Illinois Plumbing & Heating Co., Springfield, Ill., heating the addition to the Iles school. The contract is worth $3,334.

James P. Hanley & Co., Newark, N. J., plumbing and heating a new building on West Kinney street. The contract price is $5,000.

Elias Berla, Newark, N. J., steam heating the Avon Avenue School. His bid was $4,567.

A. H. Sears & Co., Aurora, Ill., installing a heating plant in the New M. E. church.

S. A. Carnes, Laurel, Miss., heating, wiring and plumbing the new High School, at his bid of $4,282.

Weatherly & Pulte, Grand Rapids, Mich., plumbing and heating the new Soldiers' Home Hospital, at $9,000.

Cleveland Steam Fitting & Supply Co., Cleveland, Ohio, steam heating the new twelve-suite apartment building for the Ballagh Building Company.

John W. Danforth Co., Buffalo, N. Y., installing the heating apparatus in one of the buildings in the State Hospital group at Rochester, N. Y. The contract price is $1,543.

The A. Burlingame Co., Newport, R. I., installing the hot water heating system in the new building being constructed for Alfred G. Vanderbilt. The heating is to be by the overhead system.

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E. J. Harrington, Fargo, N. D., heating, plumbing and electric wiring the new St. Joseph's Academy, at Jamestown. The contract is worth $5,900.

Chances for Business

Washington, D. C.—Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, until 3 P. M., March 26th next, for the construction complete of the U. S. Post Office and Court House at Fresno, Cal.

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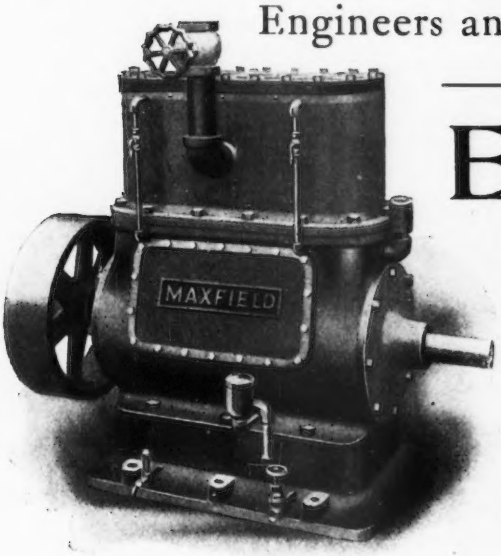

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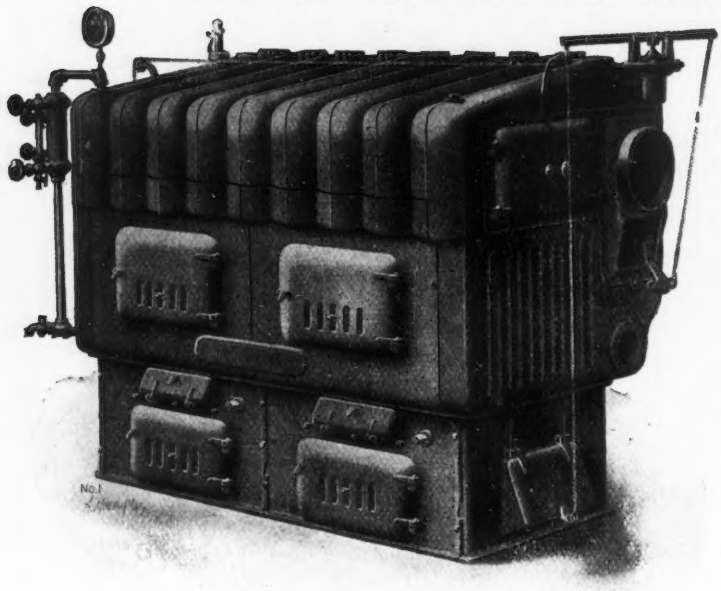

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